INSTALLATION MANUAL

CONTENTS

GENERAL 4
SAFETY CONSIDERATIONS 4
INSPECTION 4
REFERENCE 4
RENEWAL PARTS 5
APPROVALS 5
PRODUCT NOMENCLATURE 6
INSTALLATION 7
OPERATION 45
START-UP (COOLING) 53
START-UP (GAS HEAT) 53
TROUBLESHOOTING 56

See the following page for a complete Table of Contents.

NOTES, CAUTIONS AND WARNINGS

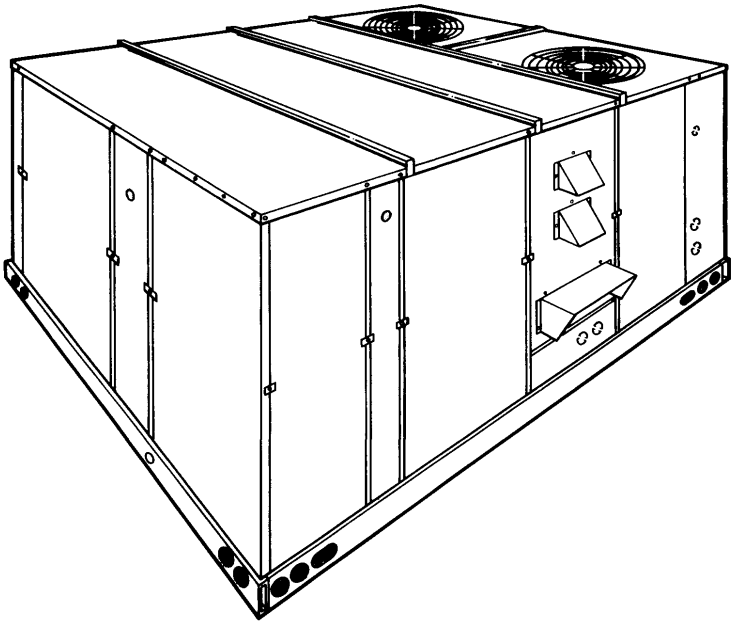
The installer should pay particular attention to the words: *NOTE*, *CAUTION*, and *WARNING*. Notes are intended to clarify or make the installation easier. Cautions are given to prevent equipment damage. Warnings are given to alert installer that personal injury and/or equipment damage may result if installation procedure is not handled properly.

CAUTION: READ ALL SAFETY GUIDES BEFORE YOU BEGIN TO INSTALL YOUR UNIT.

SAVE THIS MANUAL

SUNLINE ULTRA™ GAS/ELECTRIC SINGLE PACKAGE AIR CONDITIONERS

MODELS: DH180, 210, 240 & 300



284808-YIM-B-0707

TABLE OF CONTENTS

GENERAL 4
SAFETY CONSIDERATIONS 4
INSPECTION 4
REFERENCE 4
RENEWAL PARTS 5
APPROVALS 5
PRODUCT NOMENCLATURE 6
INSTALLATION 7
INSTALLATION SAFETY INFORMATION: 7
LIMITATIONS 7
LOCATION 8
RIGGING AND HANDLING 9
CLEARANCES 9
DUCTWORK 10
FIXED OUTDOOR AIR INTAKE DAMPER 10
CONDENSATE DRAIN 11
COMPRESSORS 11
FILTERS 11
SERVICE ACCESS 11
THERMOSTAT 13
SPACE SENSOR 13
POWER AND CONTROL WIRING 13
OPTIONAL ELECTRIC HEAT 13
OPTIONAL GAS HEAT 14
GAS PIPING 14
GAS CONNECTION 15
L.P. UNITS, TANKS AND PIPING 16
VENT AND COMBUSTION AIR HOODS 16
OPTIONAL ECONOMIZER/MOTORIZED DAMPER RAIN HOOD 17
OPTIONAL POWER EXHAUST/BAROMETRIC RELIEF DAMPER RAIN HOOD 17
OPTIONAL ECONOMIZER AND POWER EXHAUST DAMPER SET POINT ADJUSTMENTS AND INFORMATION 17
MINIMUM POSITION ADJUSTMENT 17
ENTHALPY SET POINT ADJUSTMENT 17
POWER EXHAUST DAMPER SETPOINT 17
INDOOR AIR QUALITY AQ 18
OPTIONAL BAS-READY ECONOMIZER POWER EXHAUST DAMPER SET POINT ADJUSTMENT 18
OPTIONAL VARIABLE AIR VOLUME (VAV) 18
DUCT STATIC PRESSURE TRANSDUCER 18
VAV CONTROL BOARD 18
FACTORY-INSTALLED VFD 19
MANUAL BYPASS 20
BAS-READY VFD 20
'VFD-READY' FOR CUSTOMER-INSTALLATION 21
OPTIONAL HOT GAS BYPASS (HGBP) 21
CFM, STATIC PRESSURE, AND POWER - ALTITUDE AND TEMPERATURE CORRECTIONS 33
PHASING 43
CHECKING SUPPLY AIR CFM 43
AIR BALANCE 44
OPERATION 45
SEQUENCE OF OPERATIONS OVERVIEW 45
COOLING SEQUENCE OF OPERATION 45
CONTINUOUS BLOWER 45
INTERMITTENT BLOWER 45
OPTIONAL VAV BLOWER OPERATION 45
NO OUTDOOR AIR OPTIONS 45
ECONOMIZER WITH SINGLE ENTHALPY SENSOR - . 45
ECONOMIZER WITH DUAL ENTHALPY SENSORS - . 46
ECONOMIZER (SINGLE OR DUAL ENTHALPY) WITH POWER EXHAUST - 46
ECONOMIZER WITH OPTIONAL VAV OR INTELLI-COMFORT™ CONTROL 46
ECONOMIZER WITH OPTIONAL VAV BLOWER WITH POWER EXHAUST 47
ECONOMIZER WITH OPTIONAL INTELLI-COMFORT™ WITH POWER EXHAUST 47
MOTORIZED OUTDOOR AIR DAMPERS - 47
COOLING OPERATION ERRORS 47
HIGH-PRESSURE LIMIT SWITCH 47
LOW-PRESSURE LIMIT SWITCH 47
FREEZESTAT 48
LOW AMBIENT COOLING 48
SAFETY CONTROLS 48
COMPRESSOR PROTECTION 48
FLASH CODES 48
RESET 48
ELECTRIC HEATING SEQUENCE OF OPERATIONS 48
HEATING OPERATION ERRORS 49
TEMPERATURE LIMIT 49
SAFETY CONTROLS 49
FLASH CODES 50
RESET 50
HEAT ANTICIPATOR SETPOINTS 50
GAS HEATING SEQUENCE OF OPERATIONS 50
GAS HEATING OPERATION ERRORS 51
TEMPERATURE LIMIT 51
GAS VALVE 51
SAFETY CONTROLS 51
FLASH CODES 52
RESETS 52
HEAT ANTICIPATOR SETPOINTS 52
START-UP (COOLING) 53
PRESTART CHECK LIST 53
OPERATING INSTRUCTIONS 53
POST START CHECK LIST 53
SHUT DOWN 53
START-UP (GAS HEAT) 53
PRE-START CHECK LIST 53
OPERATING INSTRUCTIONS 53
TO LIGHT PILOT AND MAIN BURNERS: 53
TO SHUT DOWN: 53
POST-START CHECK LIST (GAS) 54
MANIFOLD GAS PRESSURE ADJUSTMENT 54
PILOT CHECKOUT 54
BURNER INSTRUCTIONS 54
BURNER AIR SHUTTER ADJUSTMENT 55
CHECKING GAS INPUT 55
NATURAL GAS 55
ADJUSTMENT OF TEMPERATURE RISE 55
BELT DRIVE BLOWER 56
TROUBLESHOOTING 56

COOLING TROUBLESHOOTING GUIDE 56
GAS HEAT TROUBLESHOOTING GUIDE 60
UNIT CONTROL BOARD FLASH CODES 63
UNIT CONTROL BOARD OPTION SETUP 65
OPTION BYTE SETUP 65
HEAT DELAY SETUP 65
OPTIONAL VAV CONTROL BOARD FLASH CODES . 66

LIST OF FIGURES

Fig. # Pg. #

1 TYPICAL RIGGING 9
2 CENTER OF GRAVITY 9
3 FIXED OUTDOOR AIR DAMPER 11
4 RECOMMENDED DRAIN PIPING 11
5 TYPICAL FIELD WIRING 12
6 EXTERNAL SUPPLY CONNECTION EXTERNAL SHUT-OFF 16
7 BOTTOM SUPPLY CONNECTION EXTERNAL SHUT-OFF 16
8 VENT AND COMBUSTION AIR HOOD 17
9 ENTHALPY SETPOINT ADJUSTMENT 22
10 HONEYWELL ECONOMIZER CONTROL W7212 23
11 FOUR AND SIX POINT LOADS 23
12 CENTER OF GRAVITY 24
13 FRONT VIEW DIMENSIONS 30
14 REAR VIEW DIMENSIONS 31
15 UNIT CLEARANCES AND RAIN HOOD DIMENSIONS 32
16 ALTITUDE/TEMPERATURE CONVERSION FACTOR 34
17 BELT ADJUSTMENT 43
18 PRESSURE DROP ACROSS A DRY INDOOR COIL VS SUPPLY AIR CFM FOR ALL UNIT TONNAGES 44
19 GAS VALVE PIPING 51
20 GAS VALVE AND CONTROLS 52
21 TYPICAL GAS VALVES 54
22 PROPER FLAME ADJUSTMENT 54
23 TYPICAL FLAME APPEARANCE 55
24 UNIT CONTROL BOARD 64

LIST OF TABLES

Tbl. # Pg. #

1 UNIT APPLICATION DATA 8
2 CONTROL WIRE SIZES 13
3 ELECTRIC HEAT APPLICATION DATA 14
4 GAS HEAT APPLICATION DATA 14
5 PIPE SIZING 14
6 DH 180, 210, 240 & 300 FOUR AND SIX POINT LOAD WEIGHT DISTRIBUTION 24
7 PHYSICAL DATA 25
8 OPERATING WEIGHTS (LBS.) 25
9 SUPPLY FAN VFD WEIGHTS, IN LBS. 25
10 DH 180, 210 & 240 ELECTRICAL DATA WITHOUT POWERED CONVENIENCE OUTLET 26
11 DH 300 ELECTRICAL DATA STANDARD MOTOR WITHOUT POWERED CONVENIENCE OUTLET . . 27
12 DH 300 ELECTRICAL DATA HIGH STATIC MOTOR WITHOUT POWERED CONVENIENCE OUTLET . . 27
13 DH 180, 210 & 240 ELECTRICAL DATA WITH POWERED CONVENIENCE OUTLET 28
14 DH 300 ELECTRICAL DATA STANDARD MOTOR WITH POWERED CONVENIENCE OUTLET 29
15 DH 300 ELECTRICAL DATA HIGH STATIC MOTOR WITH POWERED CONVENIENCE OUTLET 29
16 ALTITUDE CORRECTION FACTORS 33
17 SUPPLY AIR BLOWER PERFORMANCE (15 TON) - COOLING ONLY 180 MBH - BOTTOM DUCT CONNECTIONS 35
18 SUPPLY AIR BLOWER PERFORMANCE (17.5 TON) - COOLING ONLY 210 MBH - BOTTOM DUCT CONNECTIONS 36
19 SUPPLY AIR BLOWER PERFORMANCE (20 TON) - COOLING ONLY 240 MBH - BOTTOM DUCT CONNECTIONS 37
20 SUPPLY AIR BLOWER PERFORMANCE (15 TON) - GAS HEAT 180 MBH - BOTTOM DUCT CONNECTIONS 38
21 SUPPLY AIR BLOWER PERFORMANCE (17.5 TON) - GAS HEAT 210 MBH - BOTTOM DUCT CONNECTIONS 39
22 SUPPLY AIR BLOWER PERFORMANCE (20 TON) - GAS HEAT 240 MBH - BOTTOM DUCT CONNECTIONS 40
23 SUPPLY AIR BLOWER PERFORMANCE (25 TON) - GAS HEAT 300 MBH - BOTTOM DUCT CONNECTIONS 41
24 STATIC RESISTANCES 42
25 POWER EXHAUST PERFORMANCE 42
26 BLOWER MOTOR AND DRIVE DATA 42
27 LIMIT CONTROL SETTING 49
28 ELECTRIC HEAT ANTICIPATOR SETPOINTS 50
29 LIMIT CONTROL SETTING 52
30 GAS HEAT ANTICIPATOR SETPOINTS 53
31 GAS RATE - CUBIC FEET PER HOUR 55
32 UNIT CONTROL BOARD FLASH CODES 64
33 HEAT DELAY 65
34 VAV CONTROL BOARD FLASH CODES 66

GENERAL

YORK® Model DH units are either single package air conditioners equipped with optional factory installed electric heaters, or single package gas-fired central heating furnaces with cooling unit. Both are designed for outdoor installation on a rooftop or slab.

The units are completely assembled on rigid, permanently attached base rails. All piping, refrigerant charge, and electrical wiring is factory installed and tested. The units require electric power, gas connection, duct connections, installation of combustion air inlet hood, flue gas outlet hoods and fixed outdoor air intake damper (units without economizer or motorized damper option only) at the point of installation.

The supplemental electric heaters have nickel-chrome elements and utilize single point power connection.

These gas-fired heaters have aluminized-steel or optional stainless steel, tubular heat exchangers with spark ignition with proven pilot. All gas heaters are shipped from the factory equipped for natural gas use, but can be field converted to L.P./ Propane with Kit Model # 1NP0418. See Gas Heat Application Data Table.

SAFETY CONSIDERATIONS

Due to system pressure, moving parts and electrical components, installation and servicing of air conditioning equipment can be hazardous. Only qualified, trained, service personnel should install, repair, maintain or service this equipment.

Observe all precautions in the literature, on labels and tags accompanying the equipment whenever working on air conditioning equipment. Be sure to follow all other safety precautions that apply.

Wear safety glasses and work gloves, and follow all safety codes. Use a quenching cloth and have a fire extinguisher available for all brazing operations.

⚠WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in serious injury, death, or property damage.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

- WHAT TO DO IF YOU SMELL GAS:

  - Do not try to light any appliance.
  - Do not touch any electrical switch; do not use any phone in your building.
  - Leave the building immediately.
  - Immediately call your gas supplier from a neighbor’s phone. Follow the gas supplier’s instructions.
  - If you cannot reach the gas supplier, call the fire department.

- Installation and service must be performed by a qualified installer, service agency or the gas supplier.

INSPECTION

As soon as a unit is received, it should be inspected for possible damage during transit. If damage is evident, the extent of the damage should be noted on the carrier's freight bill. A separate request for inspection by the carrier's agent should be made in writing.

REFERENCE

Additional information on the design, installation, operation and service of this equipment is available in the following reference forms:

- Technical Guide - 262260
- General Installation - 284808

RENEWAL PARTS

Contact your local York® Parts Distribution Center for authorized replacement parts.

APPROVALS

Design certified by CSA as follows:

- For use as a cooling unit only with or without optional electric heat.
- For use as a forced air furnace with cooling unit
- For outdoor installation only.
- For installation on combustible material.
- For use with natural gas or propane gas.

⚠ CAUTION

THIS PRODUCT MUST BE INSTALLED IN STRICT COMPLIANCE WITH THE ENCLOSED INSTALLATION INSTRUCTIONS AND ANY APPLICABLE LOCAL, STATE, AND NATIONAL CODES INCLUDING, BUT NOT LIMITED TO, BUILDING, ELECTRICAL, AND MECHANICAL CODES.

⚠ WARNING

IMPROPER INSTALLATION MAY CREATE A CONDITION WHERE THE OPERATION OF THE PRODUCT COULD CAUSE PERSONAL INJURY OR PROPERTY DAMAGE.

The installer should pay particular attention to the words: NOTE, CAUTION and WARNING. Notes are intended to clarify or make the installation easier. Cautions are given to prevent equipment damage. Warnings are given to alert installer that personal injury and/or equipment damage may result if installation procedure is not handled properly.

PRODUCT NOMENCLATURE

15-25 Ton Sunline Ultra™ Model Number Nomenclature

D	H	180	N24	A	2	A	AA	1	0	1	2	4	A

Product Category
D = A/C, Single Pkg., R-22

Product Identifier
H = 10.0-11.0 EER A/C

Nominal Cooling Capacity
180 = 15 Ton
210 = 17.5 Ton
240 = 20 Ton
300 = 25 Ton

Heat Type and Nominal Heat Capacity
C00 = Cooling Only. No field installed electric heat

Gas Heat Options
N24 = 240 MBH Output Aluminized Steel
N32 = 320 MBH Output Aluminized Steel
S24 = 240 MBH Output Stainless Steel
S32 = 320 MBH Output Stainless Steel

Electric Heat Options
E18 = 18 KW
E36 = 36 KW
E54 = 54 KW
E72 = 72 KW

Airflow
A = Std. Drive
B = Std. Drive/Single Input Econo.
C = Std. Drive/Single Input Econo./Power Exhaust (Downflow Only)
D = Std. Drive/Motorized Damper
E = Std. Drive/Motorized Damper/Barometric Relief
J = Std. Drive/Single Input Econo./Barometric Relief
N = Hi Static Drive
P = Hi Static Drive/Single Input Econo.
Q = Hi Static Drive/Single Input Econo./Power Exhaust (Downflow Only)
R = Hi Static Drive/Motorized Damper
K = Hi Static Drive/Motorized Damper/Barometric Relief
S = Hi Static Drive/Single Input Econo./Barometric Relief

Voltage
2 = 208/230-3-60
4 = 460-3-60
5 = 575-3-60

Product Style
A = Style A

Configuration Options (not required for all units)
These four digits will not be assigned until a quote is requested, or an order placed.

- SS Drain Pan
- CPC Controller, DFS, APS
- Johnson Controller, DFS, APS
- Honeywell Controller, DFS, APS
- Novar Controller, DFS, APS
- Simplicity IntelliComfort Controller
- Simplicity IntelliComfort Controller w/ModLinc
- Hot Gas Bypass (Standard on VAV, Optional on CV)
- Variable Air Volume, VFD (not available with factory installed BAS options)
- Variable Air Volume, VFD with ModLINC (not available with factory installed BAS options)
- Variable Air Volume, VFD and Manual Bypass (not available with factory installed BAS options)
- Variable Air Volume, VFD and Manual Bypass with ModLINC (not available with factory installed BAS options)
- Variable Air Volume, VFD (BAS ready)
- Variable Air Volume, VFD and Manual Bypass (BAS ready)
- Variable Air Volume, VFD Ready (for customer provided, field installed drive)
- Variable Air Volume, VFD Ready with ModLINC (for customer-provided, field-installed drive)
- 2" Pleated filters
- 4" Pleated filters
- BAS Ready Economizer (2-10 V.D.C. Actuator without a controller)
- Double Wall Construction
- Any Combination of Additional Options that Don't Have an Option Code Pre-assigned

Product Generation
1 = First Generation
2 = Second Generation

Additional Options

Standard Cabinet	Hinged Filter Door & Tool Free Access Cabinet
AA = None AB = Phase Monitor AC = Coil Guard AD = Dirty Filter Switch AE = Phase Monitor & Coil Guard AF = Phase Monitor & Dirty Filter Switch AG = Coil Guard & Dirty Filter Switch AH = Phase Monitor, Coil Guard & Dirty Filter Switch RC = Coil Guard & American Flag TA = Technicoat Condenser Coil TJ = Technicoat Evaporator Coil TS = Technicoat Evaporator & Condenser Coils	BA = Hinged Filter Door & Tool Free Access Panels BB = Phase Monitor, Hinged Filter Door & Tool Free Access Panels BC = Coil Guard, Hinged Filter Door & Tool Free Access Panels BD = Dirty Filter Switch, Hinged Filter Door & Tool Free Access Panels BE = Phase Monitor & Coil Guard, Hinged Filter Door & Tool Free Access Panels BF = Phase Monitor & Dirty Filter Switch, Hinged Filter Door & Tool Free Access Panels BG = Coil Guard & Dirty Filter Switch, Hinged Filter Door & Tool Free Access Panels BH = Phase Monitor, Coil Guard & Dirty Filter Switch, Hinged Filter Door & Tool Free Access Panels

ZZ = If desired option combination is not listed above, ZZ will be assigned and configuration options will be located in digits 15-18.

Installation Options

A = No Options Installed B = Option 1 C = Option 2 D = Options 1 & 2 E = Option 3 F = Option 4 G = Options 1 & 3 H = Options 1 & 4 J = Options 1, 2 & 3 K = Options 1, 2, & 4 L = Options 1,3 & 4 M = Options 1, 2, 3, & 4	N = Options 2 & 3 P = Options 2 & 4 Q = Options 2, 3, & 4 R = Options 3 & 4 S = Option 5 T = Options 1 & 5 U = Options 1, 3, & 5 V = Options 1, 4, & 5 W = Options 1, 3, 4, & 5 X = Options 3 & 5 Y = Options 4 & 5 Z = Options 3, 4 & 5

Options

1 = Disconnect 2 = Non-Pwr'd Conv. Outlet 3 = Smoke Detector S.A.	4 = Smoke Detector R.A. 5 = Pwr'd Conv. Outlet

INSTALLATION

INSTALLATION SAFETY INFORMATION:

Read these instructions before continuing this appliance installation. This is an outdoor combination heating and cooling unit. The installer must assure that these instructions are made available to the consumer and with instructions to retain them for future reference.

1. Refer to the furnace rating plate for the approved type of gas for this furnace.
2. Install this furnace only in a location and position as specified on Page 8 of these instructions.
3. Never test for gas leaks with an open flame. Use commercially available soap solution made specifically for the detection of leaks when checking all connections, as specified on Pages 7, 15, 16 and 54 of these instructions.
4. Always install furnace to operate within the furnace's intended temperature-rise range with the duct system and within the allowable external static pressure range, as specified on the unit name/rating plate, specified on Page 55 of these instructions.
5. This equipment is not to be used for temporary heating of buildings or structures under construction.

⚠WARNING

FIRE OR EXPLOSION HAZARD

FAILURE TO FOLLOW THE SAFETY WARNING EXACTLY COULD RESULT IN SERIOUS INJURY, DEATH OR PROPERTY DAMAGE.

NEVER TEST FOR GAS LEAKS WITH AN OPEN FLAME. USE A COMMERICALLY AVAILABLE SOAP SOLUTION MADE SPECIFICALLY FOR THE DETECTION OF LEAKS TO CHECK ALL CONNECTIONS. A FIRE OR EXPLOSION MAY RESULT CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.

LIMITATIONS

These units must be installed in accordance with the following national and local safety codes:

In U.S.A.:

- National Electrical Code ANSI/NFPA No. 70.
- National Fuel Gas Code Z223.1.
- Gas-Fired Central Furnace Standard ANSI Z21.47a.
- Local gas utility requirements.

In Canada:

- Current Canadian Electrical Code C22.1.
- Current Gas Installation Codes CSA-B149.1.
- Local plumbing and waste water codes.
- Other applicable local codes.

Refer to the Unit Application Data table and to the Gas Heat Application Data table.

After installation, the unit must be adjusted to obtain a temperature rise within the range specified on the unit rating plate.

If components are to be added to a unit to meet local codes, they are to be installed at the dealer's and/or the customer's expense.

Size of unit for proposed installation should be based on heat loss/heat gain calculation made according to the methods of the Air Conditioning Contractors of America (ACCA).

This furnace is not to be used for temporary heating of buildings or structures under construction.

TABLE 1: UNIT APPLICATION DATA

UNIT MODEL NUMBER		DH180	DH210	DH240	DH300
Voltage Variation, Min. / Max.[1]	208/230-3-60	187 / 253			
	460-3-60	414 / 506			
	575-3-60	518 / 630			
Supply Air CFM, Min. / Max.		4,500 / 7,200	6,000 / 9,000	6,000 / 9,400	7,500 / 12,500
Wet Bulb Temperature (ºF) of Air on Evaporator Coil, Min. / Max.		57 / 72			
Dry Bulb Temperature (ºF) of Air on Condenser Coil, Min. / Max.		0 / 120			0 / 115

1. Utilization range “A” in accordance with ARI Standard 110.

LOCATION

Use the following guidelines to select a suitable location for these units.

1. Unit is designed for outdoor installation only.
2. Condenser coils must have an unlimited supply of air.
3. Where a choice of location is possible, position the unit on either north or east side of building.
4. For ground level installation, use a level concrete slab with a minimum thickness of 4 inches. The length and width should be at least 6 inches greater than the unit base rails. Do not tie slab to the building foundation.
5. Roof structures must be able to support the weight of the unit and its options and/or accessories. Unit must be installed on a solid level roof curb or appropriate angle iron frame.
6. Maintain level tolerance to 1/2 inch maximum across the entire length or width of the unit.

⚠WARNING

Excessive exposure of this furnace to contaminated combustion air may result in equipment damage or personal injury. Typical contaminates include: permanent wave solutions, chlorinated waxes and cleaners, chlorine based swimming pool chemicals, water softening chemicals, carbon tetrachloride, Halogen type refrigerants, cleaning solvents (e.g. perchloroethylene), printing inks, paint removers, varnishes, hydrochloric acid, cements and glues, antistatic fabric softeners for clothes dryers, masonry acid washing materials.

If a unit is to be installed on a roof curb or special frame other than a York® roof curb, gasketing must be applied to all surfaces that come in contact with the unit underside.

RIGGING AND HANDLING

Exercise care when moving the unit. Do not remove any packaging until the unit is near the place of installation. Rig the unit by attaching chain or cable slings to the round lifting holes provided in the base rails. Spreaders, whose length exceeds the largest dimension across the unit, MUST BE USED. Refer to Figure 1.

Units may also be moved or lifted with a forklift, from the **side only**, providing that an accessory skid is used. LENGTH OF FORKS MUST BE A MINIMUM OF 90".

Refer to the Physical Data Table 7 for unit weights and to the Figures 2 or 12 for approximate center of gravity.

⚠ CAUTION

Before lifting a unit, make sure that all panels are in place and that its weight is distributed equally on all cables so it will lift evenly.

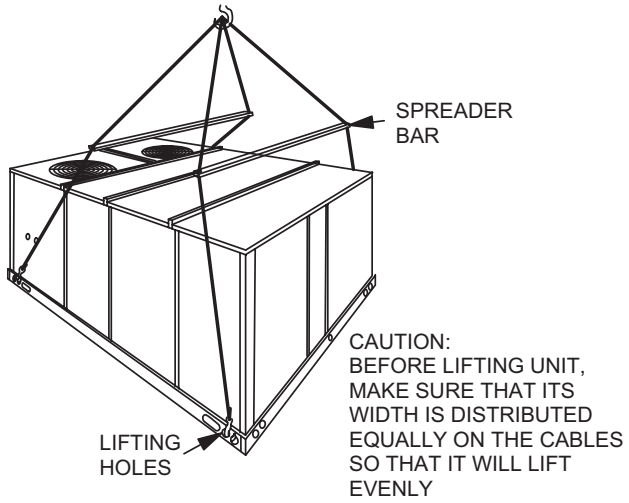

SPREADER BAR
CAUTION: BEFORE LIFTING UNIT, MAKE SURE THAT ITS WIDTH IS DISTRIBUTED EQUALLY ON THE CABLES SO THAT IT WILL LIFT EVENLY
LIFTING HOLES

FIGURE 1 - TYPICAL RIGGING

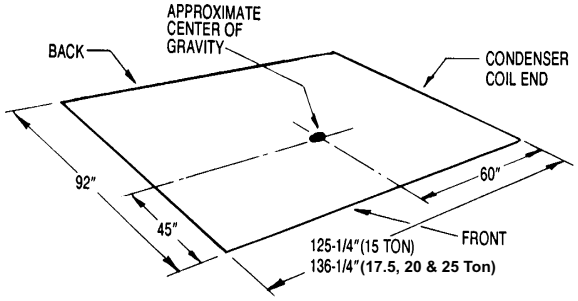


FIGURE 2 - CENTER OF GRAVITY

⚠ CAUTION

An adhesive backed label is provided over the outside of the combustion air inlet opening to prevent moisture from entering the unit, which could cause damage to electrical components. Allow this closure label to remain in place until the combustion air hood is to be installed (refer to Vent and Combustion Hood Figure 8).

CLEARANCES

All units require certain clearances for proper operation and service. Installer must make provisions for adequate combustion and ventilation air in accordance with Section 5.3, Air for Combustion and Ventilation of the National Fuel Gas Code, ANSI Z223.1 (in U.S.A.) or Sections 7.2, 7.3 or 7.4 of Gas Installation Codes CSA-B149.1 (in Canada) and/or applicable provisions of the local building codes. Refer to Figures 13, 14 and 15 for the dimensions and clearances required for combustible construction, servicing, and proper unit operation.

⚠WARNING

Do not permit overhanging structures or shrubs to obstruct outdoor air discharge outlet, combustion air inlet or vent outlets.

DUCTWORK

Ductwork should be designed and sized according to the methods in Manual Q of the Air Conditioning Contractors of America (ACCA).

A closed return duct system shall be used. This shall not preclude use of economizers or outdoor fresh air intake. The supply and return air duct connections at the unit should be made with flexible joints to minimize noise.

The supply and return air duct systems should be designed for the CFM and static requirements of the job. They should NOT be sized to match the dimensions of the duct connections on the unit.

⚠ CAUTION

When fastening ductwork to side duct flanges on unit, insert screws through duct flanges only. DO NOT insert screws through casing. Outdoor ductwork must be insulated and waterproofed.

Refer to Figures 13 and 14 for information concerning side and bottom supply and return air duct opening dimensions.

NOTE: It is recommended that, in Canada, the outlet duct be provided with a removable access panel. It is recommended that this opening be accessible when the unit is installed in service, and of a size such that smoke or reflected light may be observed inside the casing to indicate the presence of leaks in the heat exchanger. The cover should be attached in a manner adequate to prevent leakage.

FIXED OUTDOOR AIR INTAKE DAMPER

This damper is shipped inside the return air compartment. It is completely assembled and ready for installation. A damper baffle inside of the hood is adjustable to provide variable amounts of outdoor air intake on units that are not provided with an economizer or a motorized damper option. Refer to the Fixed Outdoor Damper Figure 3.

Gasketing and mounting screws are provided in a parts bag attached to the hood assembly. Apply gasketing to the three flange surfaces on the hood prior to installing the hood. Extend gasketing 1/4 inch beyond the top and bottom of the two side flanges to insure adequate sealing.

Adjusting the damper to the desired air flow may be done before mounting the hood into position or after installation by removing the front hood panel or the screen on the bottom of the hood. Damper baffle in position 1 will allow approximately 10% outdoor air flow, position 2 approximately 15% and, to allow approximately 25%, remove the damper baffle.

On units with bottom return air application install the damper assembly over the opening in the side return air access panel. Remove and discard the opening cover and the covering over the hood mounting holes (used for shipping) before installing. Secure with the screws provided.

On units with side return air applications, install the damper assembly on the return air ductwork as close to the unit as possible. Cut an opening 16 inches high by 18 inches wide in the ductwork to accommodate the damper. Using the holes in the hood flanges as a template, drill 9/64 inch dia. (#26 drill) holes into the ductwork and secure with the screws provided.

⚠ CAUTION

If outdoor air intake will not be required on units with bottom return air applications, the damper assembly should still be mounted on the side return air access panel, per the instructions above, to insure moisture is not drawn into the unit during operation. The covering over the mounting holes only need be removed. Do not remove the opening cover.

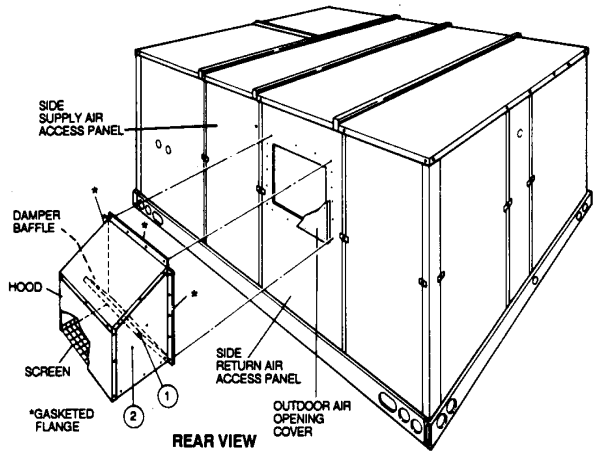


FIGURE 3 - FIXED OUTDOOR AIR DAMPER

CONDENSATE DRAIN

Plumbing must conform to local codes. Use a sealing compound on male pipe threads. Install a condensate drain line from the one-inch NPT female connection on the unit to an open drain.

NOTE: The condensate drain operates in a negative pressure in the cabinet. The condensate drain line MUST be trapped to provide proper drainage. See Figure 4.

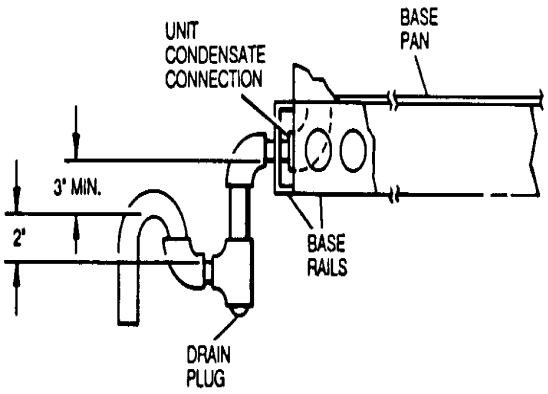


FIGURE 4 - RECOMMENDED DRAIN PIPING

COMPRESSORS

Units are shipped with compressor mountings factory-adjusted and ready for operation.

⚠ CAUTION

Do not loosen compressor mounting bolts.

FILTERS

Two-inch or four-inch filters can be supplied with each unit. Filters must always be installed ahead of the evaporator coil and must be kept clean or replaced with same size and type. Dirty filters will reduce the capacity of the unit and will result in frosted coils or safety shutdown. Minimum filter area and required sizes are shown in Physical Data Table 7.

SERVICE ACCESS

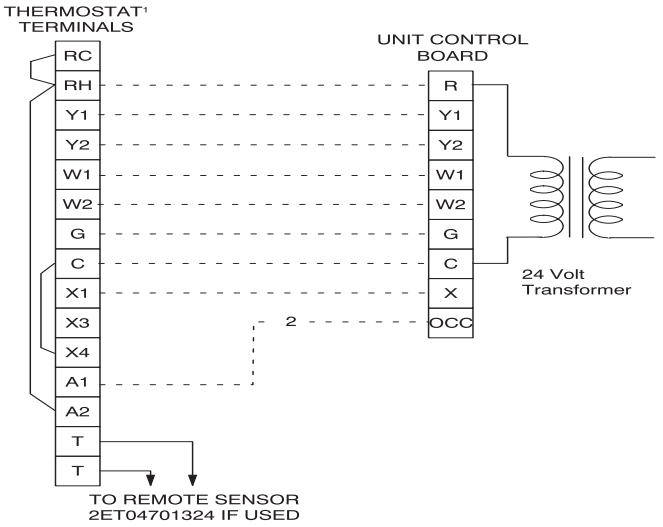
The following removable panels provide access to all serviceable components:

- Compressor compartment
- Electric Heat compartment
- Gas Heat compartment (Two panels)
- Side Supply & Return Air compartments (Two panels)
- Blower compartment (Three panels)
- Main control box
- Filter compartment
- Outdoor Air compartment (Two panels)

Refer to Figures 13 and 14 for location of these access panels.

⚠ CAUTION

Make sure that all screws and panel latches are replaced and properly positioned on the unit to maintain an airtight seal.



¹ Electronic programmable Thermostat 2ET0770010024 (includes subbase).
² Terminals A1 and A2 provide a relay output to close the outdoor economizer dampers when the thermostat switches to the set-back position.

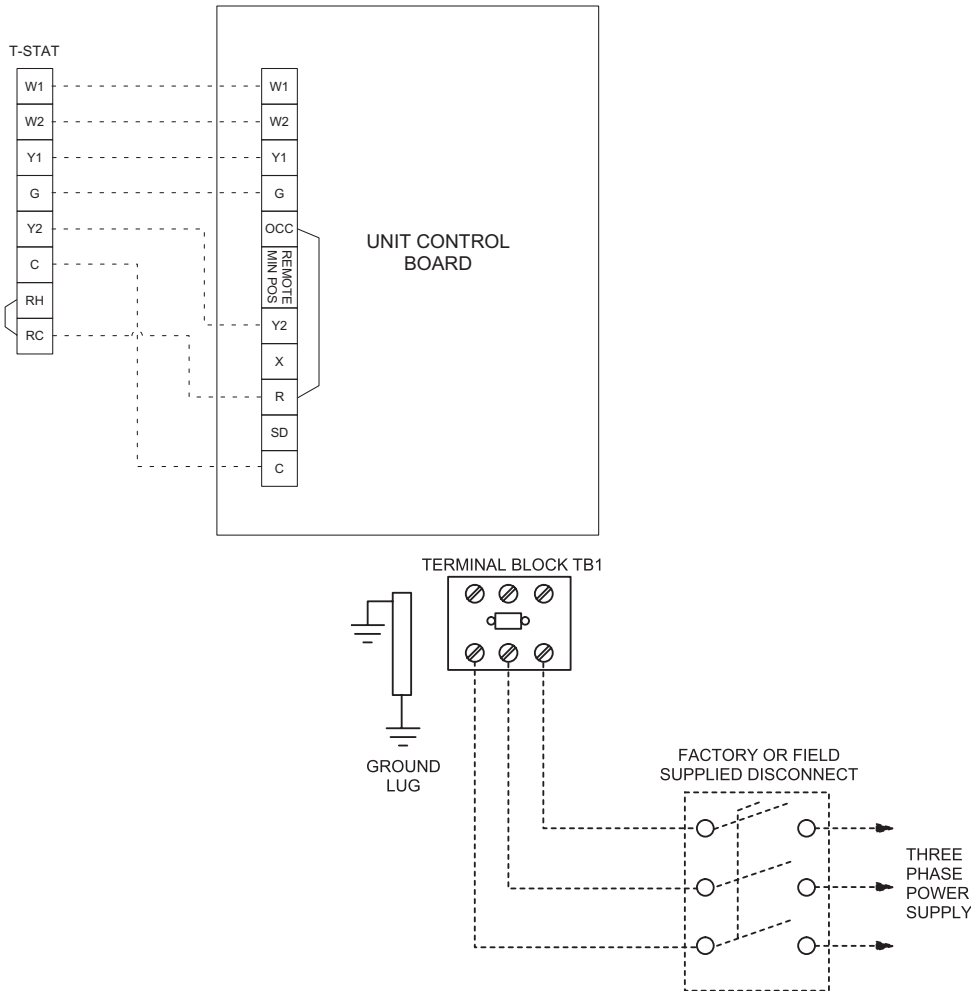


FIGURE 5 - TYPICAL FIELD WIRING

THERMOSTAT

The room thermostat should be located on an inside wall approximately 56 inches above the floor where it will not be subject to drafts, sun exposure or heat from electrical fixtures or appliances. Follow manufacturer's instructions enclosed with thermostat for general installation procedure. A minimum of seven color-coded insulated wires (#18 AWG) should be used to connect thermostat to unit.

SPACE SENSOR

The space sensor, if used, should be located on an inside wall approximately 56 inches above the floor where it will not be subject to drafts, sun exposure or heat from electrical fixtures or appliances. Follow manufacturer's instructions enclosed with sensor for general installation procedure.

POWER AND CONTROL WIRING

Field wiring to the unit must conform to provisions of the National Electrical Code, ANSI / NFPA No. 70 (in U.S.A.), current Canadian Electrical Code C22.1 (in Canada) and/or local ordinances. The unit must be electrically grounded in accordance with NEC and CEC (as specified above) and/or local codes. Voltage tolerances, which must be maintained at the compressor terminals, during starting and running conditions, are indicated on the unit Rating Plate and the Unit Application Data table.

The internal wiring harness furnished with this unit is an integral part of a CSA design certified unit. Field alteration to comply with electrical codes should not be required.

A fused disconnect switch should be field provided for the unit. The switch must be separate from all other circuits. Wire entry at knockout openings require conduit fittings to comply with NEC (in U.S.A.), CEC (in Canada) and/or local codes. Refer to Figure 13 for installation location. If any of the wire supplied with the unit must be replaced, replacement wire must be of the type shown on the wiring diagram and the same minimum gauge as the replaced wire.

Electrical line must be sized properly to carry the load. Use copper conductors only. Each unit must be wired with a separate branch circuit fed directly from the meter panel and properly fused.

⚠ CAUTION

When connecting electrical power and control wiring to the unit, waterproof type connectors **MUST BE USED** so that water or moisture cannot be drawn into the unit during normal operation. The above waterproofing conditions will also apply when installing a field-supplied disconnect switch.

Refer to the Typical Field Wiring Figure 5 and to the appropriate unit wiring diagram for control circuit and power wiring information.

TABLE 2: CONTROL WIRE SIZES

Wire Size	Maximum Length[1]
18 AWG	150 Feet

1. From the unit to the thermostat and back to the unit.

OPTIONAL ELECTRIC HEAT

The factory-installed heaters are wired for single point power supply. Power supply need only be brought into the single point terminal block and thermostat wiring to the low voltage terminal strip located in the upper portion of the unit control box.

These CSA approved heaters are located within the central compartment of the unit with the heater elements extending into the supply air chamber. Refer to Figure 13 for access panel location.

Fuses are supplied, where required, by the factory. Some KW sizes require fuses and others do not. Refer to Table 3 for minimum CFM limitations and to Tables 10 and 13 for electrical data.

TABLE 3: ELECTRIC HEAT APPLICATION DATA

NOMINAL HEATER SIZE (KW)	VOLTAGE 3-PHASE, 60 HZ	MINIMUM CFM UNIT SIZE		
		15 TON	17.5 & 20 TON	25 TON
18	208/230,460,575	4500	6000	7500
36	208/230,460,575	4500		
54	208/230	5000		
	460,575	4500		
72	208/230	5000		
	460,575	4500		

OPTIONAL GAS HEAT

These gas-fired heaters have aluminized-steel or optional stainless steel, tubular heat exchangers with spark ignition with proven pilot.

All gas heaters are shipped from the factory equipped for natural gas use, but can be field converted to L.P./ Propane with Kit Model # 1NP0418. See Gas Heat Application Data Table.

TABLE 4: GAS HEAT APPLICATION DATA

0 To 2,000 Feet Above Sea Level		2,000 To 4,500 Feet Above Sea Level		Output Capacity (Mbh)		Available on Models	Gas Rate (Ft./Hr.)	Temp. Rise ºF At Full Input[1]	
				0 To 2,000 Feet Above Sea Level	2,000 To 4,500 Feet Above Sea Level				
Max.	Min.	Max.	Min.	Max.	Max.			Min.	Max.
300	150	270	135	240	213	15, 17.5, 20 and 25 Ton	279	20	50
400	200	360	180	320	281	15, 17.5, 20 and 25 Ton	372	30	60

1. On VAV units, individual VAV boxes must be full open in heating mode to insure airflow falls within temperature rise range.

GAS PIPING

Proper sizing of gas piping depends on the cubic feet per hour of gas flow required, specific gravity of the gas and the length of run. "National Fuel Gas Code" Z223.1 (in U.S.A.) or the current Gas Installation Codes CSA-B149.1 (in Canada) should be followed in all cases unless superseded by local codes or gas utility requirements. Refer to the Pipe Sizing Table 5.

The heating value of the gas may differ with locality. The value should be checked with the local gas utility.

NOTE: There may be a local gas utility requirement specifying a minimum diameter for gas piping. All units require a one-inch pipe connection at the entrance fitting.

TABLE 5: PIPE SIZING

Length in Feet	Nominal Iron Pipe Size	
	1 in.	1-1/4 in.
10	520	1,050
20	350	730
30	285	590
40	245	500
50	215	440
60	195	400
70	180	370
80	170	350
90	160	320
100	150	305

Maximum capacity of pipe in cubic feet of gas per hour. (Based upon a pressure drop of 0.3 inch water column and 0.6 specific gravity gas).

GAS CONNECTION

The gas supply line can be routed through the knockouts located on the front of the unit or through the opening provided in the unit's base. Refer to Figure 13 to locate these access openings. Typical supply piping arrangements are shown in the figures on Page 16. All shaded items are field-supplied.

If gas supply line is routed through the unit's base ensure that the burner assembly can be removed for maintenance without disturbing the supply line. The supply piping and fittings must lie below the bottom gas manifold to avoid interference with the burner assembly.

Two grommets are shipped in the blower compartment (in parts bag taped to the blower housing) of every unit with gas heat and should be used in the knockouts when the gas piping penetrates the front of the unit.

After the gas supply piping has been installed, the bottom opening in the unit should be sealed to prevent water from leaking into the building.

Gas piping recommendations:

1. A drip leg and a ground joint union must be installed in the gas piping.
2. When required by local codes, a manual shut-off valve may have to be installed outside of the unit.
3. Use wrought iron or steel pipe for all gas lines. Pipe compound should be applied sparingly to male threads only.

⚠WARNING

Natural gas may contain some propane. Propane, being an excellent solvent, will quickly dissolve white lead or most standard commercial compounds. Therefore, a special pipe compound must be applied when wrought iron or steel pipe is used. Shellac base compounds such as Gaskolac or Stalastic, and compounds such as Rectorseal #5, Clyde's or John Crane may be used.

4. All piping should be cleaned of dirt and scale by hammering on the outside of the pipe and blowing out the loose dirt and scale. Before initial start-up, be sure that all of the gas lines external to the unit have been purged of air.
5. The gas supply should be a separate line and installed in accordance with all safety codes as prescribed under "Limitations". After the gas connections have been completed, open the main shut-off valve admitting normal gas pressure to the mains. Check all joints for leaks with soap solution or other material suitable for the purpose. **NEVER USE A FLAME**.

⚠WARNING

FIRE OR EXPLOSION HAZARD

FAILURE TO FOLLOW THE SAFETY WARNING EXACTLY COULD RESULT IN SERIOUS INJURY, DEATH OR PROPERTY DAMAGE.

NEVER TEST FOR GAS LEAKS WITH AN OPEN FLAME. USE A COMMERICALLY AVAILABLE SOAP SOLUTION MADE SPECIFICALLY FOR THE DETECTION OF LEAKS TO CHECK ALL CONNECTIONS. A FIRE OR EXPLOSION MAY RESULT CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.

6. The furnace and its individual manual shut-off valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psig (3.48kPa).

   The furnace must be isolated from the gas supply piping system by closing its individual manual shut-off valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psig (3.48kPa).

7. A 1/8 inch NPT plugged tap, accessible for test gage connection, must be installed immediately upstream of the gas supply connection to the furnace.

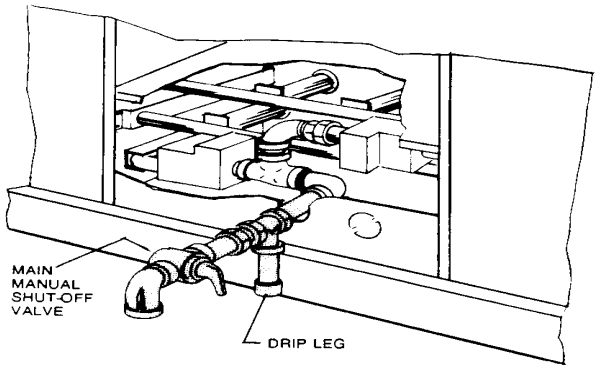


FIGURE 6 - EXTERNAL SUPPLY CONNECTION EXTERNAL SHUT-OFF

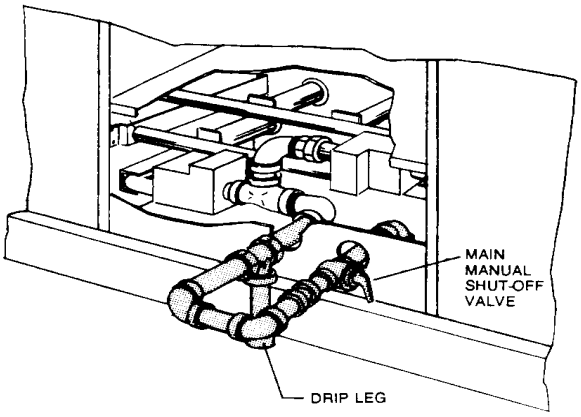


FIGURE 7 - BOTTOM SUPPLY CONNECTION EXTERNAL SHUT-OFF

L.P. UNITS, TANKS AND PIPING

All gas heat units are shipped from the factory equipped for natural gas use only. The unit may be converted in the field for use with L.P./propane gas with accessory kit model number 1NP0418.

All L.P./propane gas equipment must conform to the safety standards of the National Fire Protection Association.

For satisfactory operation, L.P./propane gas pressure must be 10.0 I.W.C. at the unit manifold under full load. Maintaining proper gas pressure depends on three main factors:

1. The vaporization rate depends on (a) the temperature of the liquid and (b) the "wetted surface" area of the container or containers.
2. The proper pressure regulation. (Two-stage regulation is recommended from the standpoint of both cost and efficiency.)
3. The pressure drop in the lines between regulators and between the second stage regulator and the appliance. Pipe size required will depend on the length of the pipe run and the total load of all appliances.

Complete information regarding tank sizing for vaporization, recommended regulator settings, and pipe sizing is available from most regulator manufacturers and L.P./propane gas suppliers.

L.P./propane gas is an excellent solvent and special pipe compound must be used when assembling piping for this gas as it will quickly dissolve white lead or most standard commercial compounds. Shellac base compounds such as Rectorseal #5 are satisfactory for this type of gas.

Check all connections for leaks when piping is completed, using a soap solution. **NEVER USE A FLAME**.

⚠WARNING

FIRE OR EXPLOSION HAZARD

FAILURE TO FOLLOW THE SAFETY WARNING EXACTLY COULD RESULT IN SERIOUS INJURY, DEATH OR PROPERTY DAMAGE.

NEVER TEST FOR GAS LEAKS WITH AN OPEN FLAME. USE A COMMERICALLY AVAILABLE SOAP SOLUTION MADE SPECIFICALLY FOR THE DETECTION OF LEAKS TO CHECK ALL CONNECTIONS. A FIRE OR EXPLOSION MAY RESULT CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.

VENT AND COMBUSTION AIR HOODS

Two vent hoods and a combustion air hood (with screens) are shipped attached to the blower housing in the blower compartment. For units with factory installed VFD option, the hoods and accompanying hardware are shipped inside the gas heat section. These hoods must be installed to assure proper unit function. All hoods must be fastened to the outside of the gas heat access panel with the screws provided in the bag also attached to the blower housing.

The screen for the combustion air intake hood is secured to the inside of the access panel opening with four fasteners and the screws used for mounting the

hood to the panel. The top flange of this hood slips in under the top of the access panel opening when installing. Refer to Vent and Combustion Air Hood Figure 8.

Each vent hood is installed by inserting the top flange of the hood into the slotted opening in the access panel and securing in place.

The products of combustion are discharged horizontally through these two screened, hooded vent openings on the upper gas heat access panel.

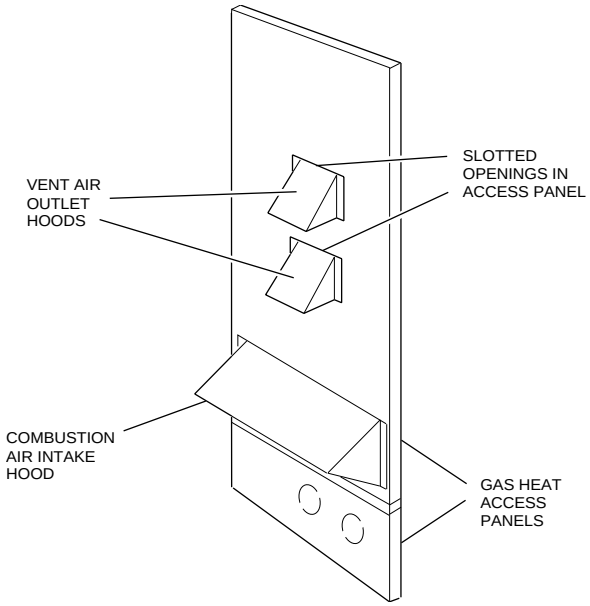


FIGURE 8 - VENT AND COMBUSTION AIR HOOD

OPTIONAL ECONOMIZER/MOTORIZED DAMPER RAIN HOOD

The instruction for the optional economizer/motorized damper rain hood can be found in the kit. Use these instructions when field assembling an economizer rain hood onto a unit. The outdoor and return air dampers, the damper actuator, the damper linkage, the outdoor and return air divider baffles, and all the control sensors are factory mounted as part of the "Factory installed" economizer option.

OPTIONAL POWER EXHAUST/BAROMETRIC RELIEF DAMPER RAIN HOOD

The instructions for the power exhaust/barometric relief damper rain hood can be found in the kit. The exhaust fan, all supporting brackets, angles, and the wiring are factory installed as part of the power exhaust option.

OPTIONAL ECONOMIZER AND POWER EXHAUST DAMPER SET POINT ADJUSTMENTS AND INFORMATION

Remove the economizer access panel from the unit. Loosen but do not remove the two panel latches. Locate the economizer control module, where the following adjustments will be made.

⚠ CAUTION

EXTREME CARE MUST BE EXCERCISED IN TURNING ALL SETPOINT, MAXIMIUM, AND MINIMUM DAMPER POSITIONING ADJUSTMENT SCREWS TO PREVENT TWISTING THEM OFF.

Check that the damper blades move smoothly without binding; carefully turn the Minimum Position Adjusting screw (found on the damper control module) fully clockwise and then set the thermostat indoor fan switch to the on position and then off, or energize and de-energize terminals "R" to "G".

MINIMUM POSITION ADJUSTMENT

With thermostat set to indoor fan on position, or terminals "R" to "G" energized, turn the Minimum Position Adjusting screw (located on the damper control module) counterclockwise until the desired minimum damper position has been attained.

ENTHALPY SET POINT ADJUSTMENT

The enthalpy set point may now be set by selecting the desired setpoint shown in the Enthalpy Setpoint Adjustment Figure 9. Adjust as follows:

- For a single enthalpy operation carefully turn the set point adjusting screw (found on the damper control module) to the "A", "B", "C" or "D" setting corresponding to the lettered curve of the Enthalpy Setpoint Adjustment Figure 9.
- For a dual enthalpy operation, carefully turn the set point adjusting screw fully clockwise past the "D" setting.

POWER EXHAUST DAMPER SETPOINT

With power exhaust option, each building pressurization requirement will be different. The point at which the power exhaust comes on is determined by the econo-

mizer damper position (Percent Open). The Exhaust Air Adjustment Screw should be set at the Percent Open of the economizer damper at which the power exhaust is needed. It can be set from 0 to 100% damper open.

INDOOR AIR QUALITY AQ

Indoor Air quality (indoor sensor input): Terminal AQ accepts a +2 to +10 Vdc signal with respect to the (AQ1) terminal. When the signal is below it's setpoint, the actuator is allowed to modulate normally in accordance with the enthalpy and mixed air sensor inputs. When the AQ signal exceeds it's setpoint setting and there is no call for free cooling, the actuator is proportionately modulated from the 2 to 10 Vdc signal, with 2 Vdc corresponding to full closed and 10 Vdc corresponding to full open. When there is no call for free cooling, the damper position is limited by the IAQ Max damper position setting. When the signal exceeds it's setpoint (Demand Control Ventilation Setpoint) setting and there is a call for free cooling, the actuator modulates from the minimum position to the full open position based on the highest call from either the mixed air sensor input or the AQ voltage input.

- Optional CO_2 Space Sensor Kit Part # 2AQ04700324
- Optional CO_2 Unit Sensor Kit Part # 2AQ04700424

Replace the economizer access panel.

OPTIONAL BAS-READY ECONOMIZER POWER EXHAUST DAMPER SET POINT ADJUSTMENT

Remove the economizer access panel from the unit. Loosen, but do not remove the two panel latches. Locate the economizer actuator, where the following adjustment can be made.

With power exhaust option, each building pressurization requirement will be different. The point at which the power exhaust comes on is determined by the economizer's outdoor damper position. The actuator's auxiliary switch adjustment screw should be set at the damper position at which the power exhaust is needed. The adjustment screw can be set between 25 to 85 degrees open.

Replace the economizer access panel.

OPTIONAL VARIABLE AIR VOLUME (VAV)

A variable air volume (VAV) option using a variable frequency drive (VFD) is available for applications requiring a constant supply duct static pressure. A differential pressure transducer is used to monitor supply duct static pressure and return a speed reference signal to the VFD to control the output of the indoor blower motor.

DUCT STATIC PRESSURE TRANSDUCER

A 0-5" WC pressure transducer, located in the control box compartment, is used to sense static (gauge) pressure in the supply air duct and convert this pressure measurement to a proportional 0-5 VDC electrical output.

Pressure-transmitting plastic tubing (1/4" diameter) must be field supplied and installed from the transducer to both the ductwork and to the atmosphere. Connect the tubing from the 'HIGH' pressure tap of the transducer to a static pressure tap (field supplied) in the supply duct located at a point where constant pressure is expected. To prevent an unstable signal due to air turbulence, there should be no obstructions, turns or VAV terminal boxes up- or down-stream of the sensing tube location for at least a distance of 6-10 times the duct diameter. Tubing must also be run between the 'LOW' pressure tap of the transducer and atmospheric pressure (outside of the unit).

⚠ CAUTION

Do not run plastic tubing in the supply or return air ducts as air movement could cause erroneous pressure measurements. If the tubing penetrates through the bottom of the unit be sure openings are sealed to prevent air and water leakage.

VAV CONTROL BOARD

A VAV control board, located in the top-left corner of the control box, is used to convert the pressure transducer input signal into a speed reference signal that the drive uses to control the speed of the blower motor. This modulating speed reference signal is generated using an internal algorithm which continuously calculates an output value.

A brief description of the VAV board's I/O terminals that are used follows:

Inputs:

- **DUCT PRES** - a 0-5 VDC analog input provided by a factory-installed duct static pressure transducer located in the unit's control box.
- **SAT** - analog input provided by a factory-installed 10k-ohm, type 3 thermistor located in the unit's supply air compartment.
- **RAT** - analog input provided by a factory-installed 10k-ohm, type 3 thermistor located in the unit's return air compartment.
- **OAT** - analog input provided by a factory-installed 10k-ohm, type 3 thermistor located in the outdoor air compartment or mounted within the evaporator base rail for units without the installed economizer option.
- **ST** - analog input provided by field-installed space temperature sensor.
- **OH** - a 0-10 VDC analog input provided by a field-installed outdoor air relative humidity sensor for single enthalpy economizer configuration.
- **RH** - a 0-10 VDC analog input provided by a field-installed return air relative humidity sensor for dual enthalpy economizer configuration (used with OH).
- **IAQ** - a 0-10 VDC analog input provided by a field-installed carbon dioxide sensor which monitors indoor air quality (CO2 concentration) and enables call for Demand Ventilation mode for units installed with economizer option.
- **OAQ** - a 0-10 VDC analog input provided by a field-installed carbon dioxide sensor which monitors outdoor air quality (CO2 concentration) and, along with IAQ, enables call for Differential Demand Ventilation mode for units installed with economizer option.
- **APS** - a 24 VAC binary input provided by a field-installed air proving switch which monitors the pressure difference across the indoor blower.
- **PUR** - a 24 VAC binary input for building purge calls from an external source.
- **OCC** - a 24 VAC binary input used to set the building occupancy status for the control.
- **LIMIT 2** - a 24 VAC binary input which either confirms 2nd-stage gas heat operation or receives an error signal from the variable frequency drive.

Outputs:

- **FAN** - a 2-10 VDC analog output signal sent to the VFD to modulate the speed of the indoor blower motor.
- **ECON** - a 2-10 VDC analog output signal sent to the economizer actuator to modulate position of the return air and outdoor air dampers (optional).
- **EXH ~** - a 24 VAC binary output signal used to turn on/off the power exhaust relay (optional).
- **VAV BOX** (gas/electric heat only) - a normally open relay contact connected to a terminal block, used to drive the building's VAV boxes to full-open during heating operation.

Programmable set points:

The *duct static set point* is the pressure that the drive will maintain when operating the unit in VAV mode. The set-point is adjustable between 0" WC and 5" WC with the default setting of 1.5" WC.

The *duct static high-limit set point* is the maximum allowable duct pressure to prevent damage from over-pressurization of the ductwork in the event of either a drive or damper failure. The high-limit set-point is adjustable between 0" WC and 5" WC with the factory default setting of 4.5" WC. If the duct static pressure reaches the high-limit set point, then the supply fan motor will be shutdown.

NOTE: Either of the set points described above can be changed through the unit control board (UCB) with the use of a USB-to-RS485 converter, personal computer or PDA and a down-loaded copy of the Simplicity® software available at the UPGnet Commercial Product Catalog website.

⚠ CAUTION

The customer must be aware of the duct pressure design limit, and what the duct pressure sensor is reading when the peak pressure is reached (ie the pressure transducer sensing tube may not be located at the place of highest pressure in the system).

FACTORY-INSTALLED VFD

The factory-installed VFD is mounted in the Blower Access Compartment above the blower assembly. The drive comes wired from the factory to include both 3-

phase power and control connections (run permit signal, speed reference signal & fault signal).

All required drive parameters are pre-programmed at the factory, except in the case of 208-volt applications, in which the parameter that defines motor nameplate voltage must be changed to a value of 208.00 and the parameter that defines motor-rated current must be changed to the appropriate value appearing on the motor's nameplate. Refer to the enclosed drive material or access the UPGnet Commercial Product Catalog website for instructions on changing parameter settings.

For units also equipped with gas/electric heat, a terminal block located in the unit's control box and connected to the VAV board's "VAV BOX" terminal, must be field wired to the building's VAV boxes to ensure fully open dampers during heating operation.

MANUAL BYPASS

An optional, factory-installed manual bypass switch available with factory-installed VFD can be found in the Blower Motor Access compartment and has the following three positions:

- **DRIVE** - routes power through the VFD for modulating control of the indoor blower motor.
- **LINE** (or BYPASS) - routes power directly to the motor which provides full-speed motor operation and complete electrical isolation of the drive.
- **TEST** - routes power to the VFD but not to the motor to allow for drive programming and/or diagnostics.

If a drive failure occurs, the unit does not automatically switch to bypass mode. The LINE/DRIVE/TEST switch must be manually switched to the LINE (BYPASS) position. If there is a call for the fan, the indoor blower motor will run at full-speed while in the bypass mode.

⚠ CAUTION

If the unit is operated with the manual bypass switch in the LINE (BYPASS) position and there are VAV boxes present in the duct system, then boxes must be driven to the full-open position using a customer-supplied power source to prevent over-pressurizing and possible damage to the ductwork.

⚠ WARNING

Before beginning any service, disconnect all power to the drive. Be aware that high voltages are present in the drive even after power has been disconnected. Capacitors within the drive must be allowed to discharge before beginning service.

BAS-READY VFD

Factory-installed VFD is also available with 'BAS-ready' models. Terminal blocks are provided in the control box (in place of the VAV control board) for field wiring of a customer-installed BAS to receive 24 VAC power and to connect to the following control signals:

- a duct static pressure transducer input signal (0-5 VDC)
- an economizer actuator input signal (2-10 VDC)
- an economizer actuator output signal (2-10 VDC)
- a VFD speed reference output signal (2-10 VDC)

The use of shielded cable is recommended for the above control wiring connections.

NOTE: Factory-installed VFD is not available with factory-installed BAS options due to space limitations in the control box.

A solid-state, lock-out relay (LR) and 100-µF, 50 VDC capacitor must be field-supplied and installed to provide a means to transmit a potential fault signal back to the BAS controller. The specific relay part number required will depend upon the need for either AC-output or DC-output. See price pages for further details.

Once the appropriate relay and capacitor are obtained, install the capacitor across LR terminals '3' & '4' and make the following wiring connections:

- LR '1' to BAS controller
- LR '2' to BAS controller
- LR '3' to UCB 'X'
- LR '4' to UCB 'C'

'VFD-READY' FOR CUSTOMER-INSTALLATION

Units configured as 'VFD-ready' provide provisions for a customer-installed drive. The physical dimensions of VFDs can vary greatly among manufacturers, horsepower ratings and voltage requirements. Keep in mind that drive manufacturers also require various minimum clearances to allow for adequate internal cooling of the drive during operation.

The unit comes with a mounting bracket installed in the Blower Access compartment which may accommodate other vendor's drives depending on their size. In order to utilize the unit's mounting bracket, the maximum recommended drive dimensions are as follows:

For 5-hp motor applications..... 10" H x 6" W x 7" D

For 7.5 thru 15-hp motor applications..... 13" H x 8" W x 8" D

If the drive will not fit in the allotted space, then it will need to be mounted elsewhere; either within the building on a perpendicular wall which is not subjected to excessive temperature, vibration, humidity, dust, corrosive gas, explosive gas, etc., or within an appropriate enclosure rated for outside installation to safeguard against moisture, dust and excessive heat.

The power leads to the drive (L1, L2, L3) and from the motor (T1, T2, T3) along with the respective ground wires are supplied with the unit and need to be connected after the drive is installed.

⚠ CAUTION

Do not connect AC power to the T1, T2, T3 drive terminals to prevent damage to the VFD.

A terminal block located in the control box is provided for field connection of the VFD speed reference signal (2-10 VDC) and to the normally-open, run-permit auxiliary contact. The use of shielded cable is recommended for the above control wiring connections.

For VFD-ready units also equipped with gas/electric heat, a terminal block located in the unit's control box and connected to the VAV board's "VAV BOX" terminal, must be field wired to the building's VAV boxes to ensure fully open dampers during heating operation.

OPTIONAL HOT GAS BYPASS (HGBP)

To allow for low cooling load operation, a direct-acting, pressure-modulating bypass control valve installed on the system #1 discharge line is used to divert high temperature, high pressure refrigerant around the TXV in order to maintain a desired minimum evaporator pressure.

The opening pressure of the bypass valve is fully adjustable between 0 and 80 psig with a factory-setting of 60 psig. HGBP is standard on all units with VAV and optional with CV units.

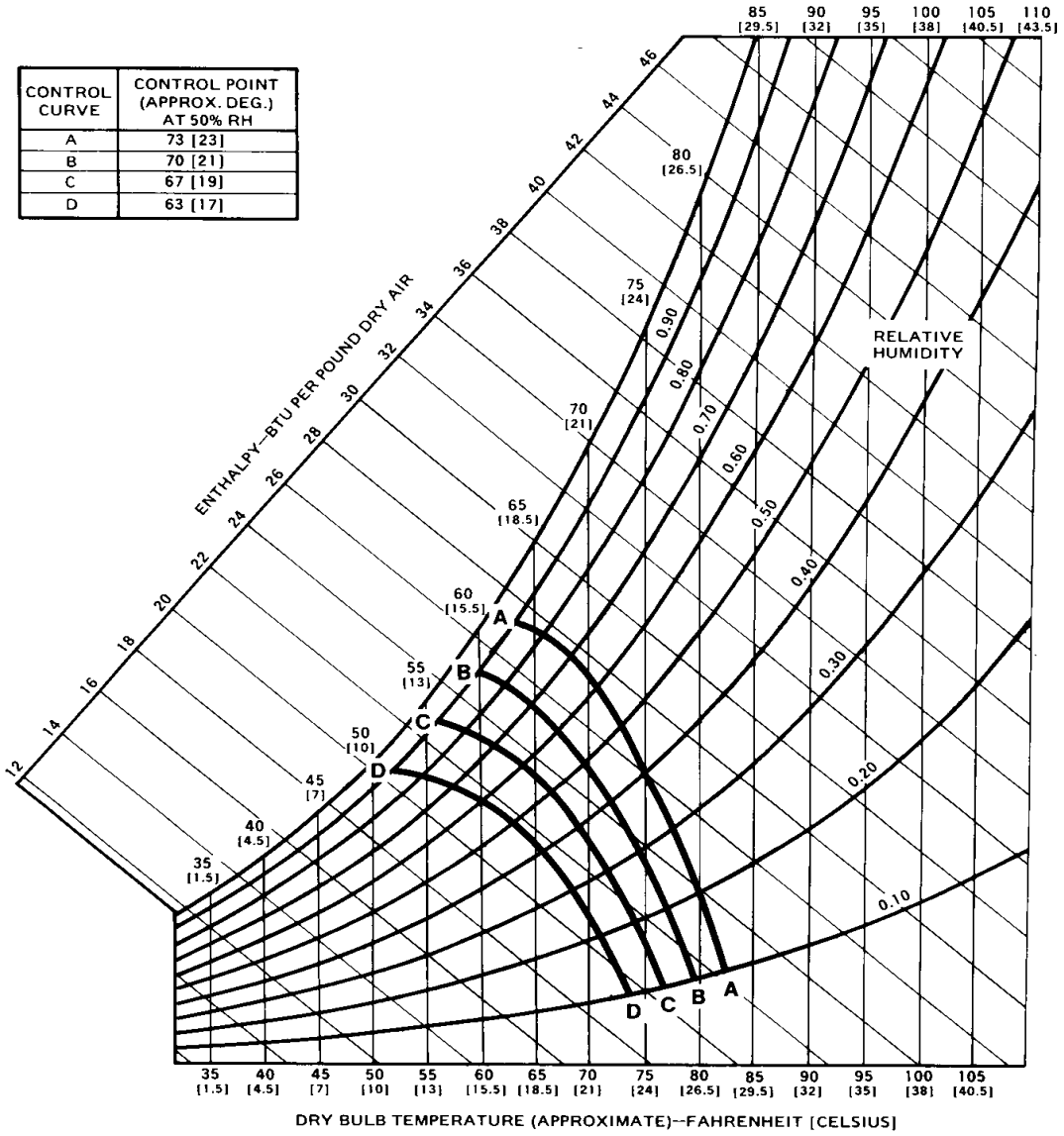


FIGURE 9 - ENTHALPY SETPOINT ADJUSTMENT

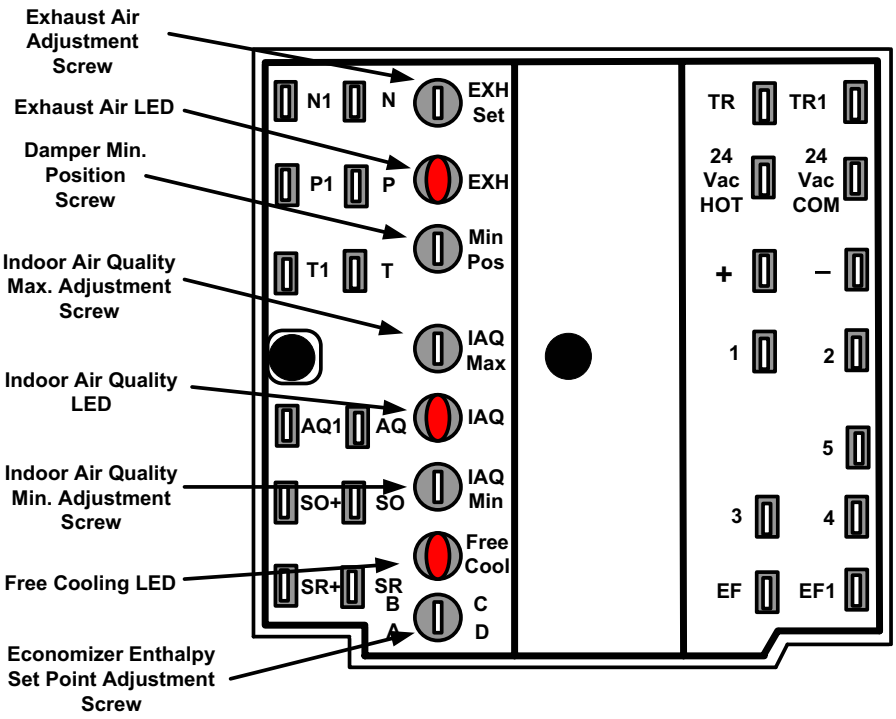


FIGURE 10 - HONEYWELL ECONOMIZER CONTROL W7212

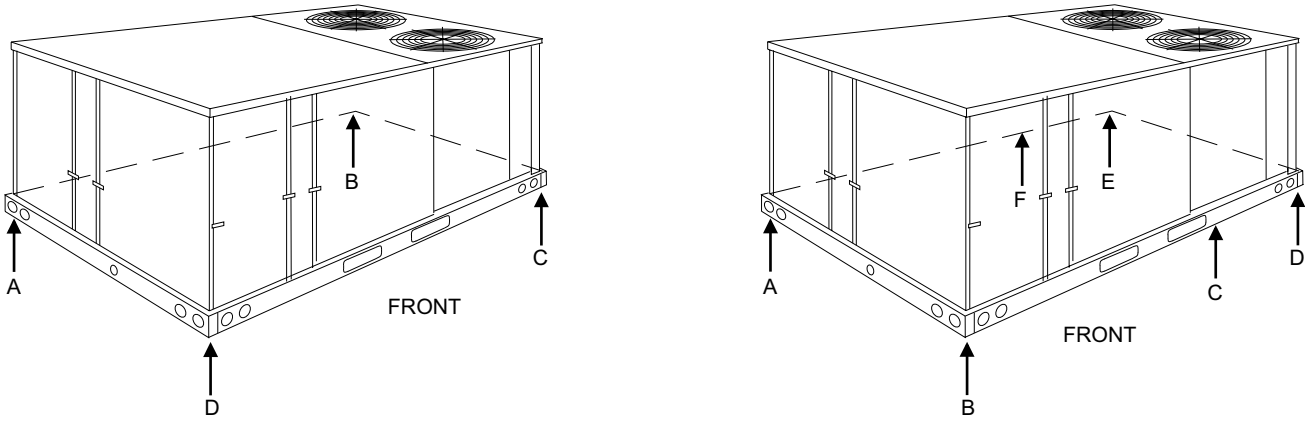


FIGURE 11 - FOUR AND SIX POINT LOADS

TABLE 6: DH 180, 210, 240 & 300 FOUR AND SIX POINT LOAD WEIGHT DISTRIBUTION

UNIT MODEL	OPERATING WEIGHT (lb)	A	B	C	D
DH180C00	1900	445	484	506	465
DH180N24	2100	492	535	559	514
DH180N32	2140	501	545	570	524
DH210C00	1950	457	497	519	477
DH210N24	2150	504	548	572	526
DH210N32	2190	513	558	583	536
DH240C00	2100	492	535	559	514
DH240N24	2300	539	586	612	563
DH240N32	2340	548	596	623	573
DH300C00	2345	461	502	720	662
DH300N24	2545	501	545	781	718
DH300N32	2585	509	553	794	729

UNIT MODEL	OPERATING WEIGHT (lb)	A	B	C	D	E	F
DH180C00	1900	293	306	323	342	327	309
DH180N24	2100	324	338	357	378	362	342
DH180N32	2140	330	344	364	385	369	348
DH210C00	1950	300	314	332	351	336	317
DH210N24	2150	331	346	366	387	370	350
DH210N32	2190	337	352	372	394	377	357
DH240C00	2100	324	338	357	378	362	342
DH240N24	2300	354	370	391	414	396	374
DH240N32	2340	360	377	398	421	403	381
DH300C00	2345	303	321	339	487	460	435
DH300N24	2545	329	348	368	528	499	472
DH300N32	2585	334	353	374	537	507	479

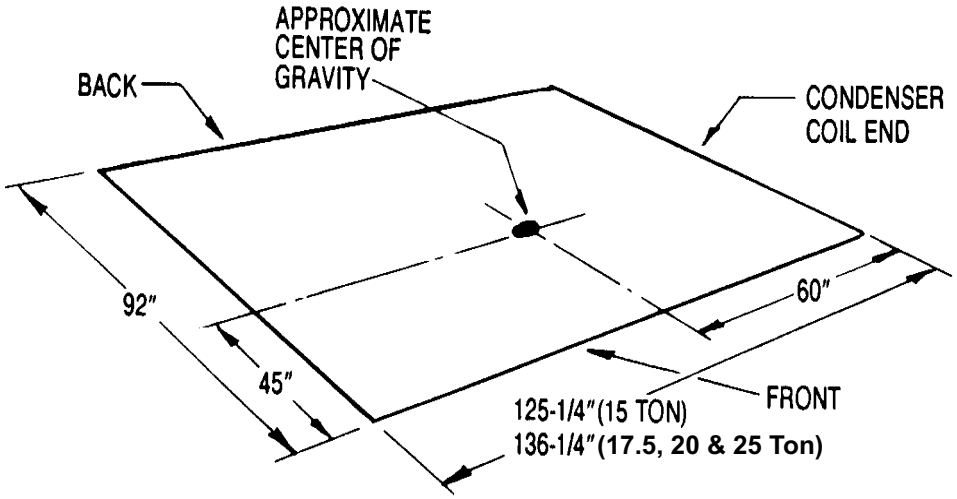


FIGURE 12 - CENTER OF GRAVITY

TABLE 7: PHYSICAL DATA

MODELS			DH			
			180	210	240	300
EVAPORATOR BLOWER	Centrifugal Blower (Dia. x Wd. in.)		15 x 15	18 x 15	18 x 15	18 x 15
	Fan Motor HP Standard/Hi Static		5	7.5	7.5	10/15
EVAPORATOR COIL	Rows Deep		4	4	4	4
	Fins Per Inch		13.5	13.5	13.5	13.5
	Face Area (Sq. Ft.		15.5	20.0	20.0	25.0
CONDENSER FANS (Two Per Unit)	Propeller Dia. (in.) (Each)		30	30	30	30
	Fan Motor Hp (Each)		1	1	1	1
	Nom. CFM (Each)		5765	7000	7000	7200
CONDENSER COILS (Two Per Unit)	Rows Deep (Each)		3	3	3	2
	Fins Per Inch (Each)		13	15	15	20
	Face Area (Sq. Ft.) (Total)		36.0	43.3	43.3	43.3
COMPRESSOR (Qty. Per Unit)	7.5 Ton Scroll		2	2	-	-
	10 Ton Scroll		-	-	2	-
	12.5 Ton Scroll		-	-	-	2
AIR FILTERS	Quantity Per Unit (16” X 20” X 2” or 4“)		-	4	4	4
	Quantity Per Unit (16” X 25” X 2” or 4“)		-	4	4	4
	Quantity Per Unit (18” X 24” X 2” or 4“)		5	-	-	-
	Total Face Area (sq. ft.)		15.0	20.0	20.0	20.0
CHARGE	Refrigerant 22 (lbs./oz.)	System #1	23/10	24/0	24/2	21/1
		System #2	21/10	24/8	27/2	21/1

TABLE 8: OPERATING WEIGHTS (LBS.)

MODEL SIZE			15 TON	17.5 TON	20 TON	25 TON
BASIC UNIT	DH (Cooling Only)		1900	1950	2100	2345
	DH (Gas/Electric)	240Mbh	2100	2150	2300	2545
		320Mbh	2140	2190	2340	2585
OPTIONS	Economizer		160			
	Economizer with Power Exhaust		245			
	Motorized Damper		150			
	Electric Heater (DH only)	18kW	25			
		36kW	30			
		54kW	35			
		72kW	40			
	Hot Gas Bypass		10			
	Supply Fan VFD		See Table 9			
ACCY.	Roof Curb		175	185	185	185
	Barometric Damper		45			
	Economizer/Motorized Damper Rain Hood		55			
	Economizer/Power Exhaust Rain Hood		90			
	Wood Skid		220			

TABLE 9: SUPPLY FAN VFD WEIGHTS, IN LBS.

SUPPLY FAN MOTOR	230V	460V	575V
W/O MANUAL BYPASS			
5.0 hp	25	25	30
7.5 hp	30	30	30
10.0 hp	30	30	35
15.0 hp	30	30	40
W/MANUAL BYPASS			
5.0 hp	30	30	35
7.5 hp	35	35	35
10.0 hp	35	35	40
15.0 hp	40	35	45

TABLE 10: DH 180, 210 & 240 ELECTRICAL DATA WITHOUT POWERED CONVENIENCE OUTLET

MODEL (TON-NAGE)	VOLTAGE	COMPRESSORS		OD FAN MOTORS FLA EACH	ID BLOWER MOTOR FLA	CONV OUTLET AMPS	HEATER OPTION				MIN. CIRCUIT AMPACITY (AMPS)	MAX. FUSE/ BRKR[1] SIZE (AMPS)
		RLA EACH	LRA EACH				MODEL	KW	STAGES	AMPS		
DH180 (15)	208-3-60	21.8	184	4.5	12.8	0.0	None	--	--	--	70.9	90
							E18	13.5	1	37.5	70.9	90
							E36	27	2	74.9	109.7	110
							E54	40.6	2	112.7	156.9	175
							E72	54.1	2	150.2	166.2	200
	230-3-60	21.8	184	4.3	12.8	0.0	None	--	--	--	70.5	90
							E18	18.0	1	43.3	70.5	90
							E36	36.0	2	86.6	124.3	125
							E54	54.0	2	129.9	145.9	175
							E72	72.0	2	173.2	189.2	225
	460-3-60	11.0	90	2.2	6.4	0.0	None	--	--	--	35.6	45
							E18	18.0	1	21.7	35.6	45
							E36	36.0	2	43.3	62.1	70
							E54	54.0	2	65.0	73.0	80
							E72	72.0	2	86.6	94.6	110
	575-3-60	9.6	73	1.7	5.2	0.0	None	--	--	--	30.2	35
							E18	18.0	1	17.3	30.2	35
							E36	36.0	2	34.6	49.8	50
							E54	54.0	2	52.0	58.5	70
							E72	72.0	2	69.3	75.8	90
DH210 (17 1/2)	208-3-60	25.6	190	4.5	20.0	0.0	None	--	--	--	86.6	110
							E18	13.5	1	37.5	86.6	110
							E36	27	2	74.9	118.7	125
							E54	40.6	2	112.7	165.9	175
							E72	54.1	2	150.2	175.2	200
	230-3-60	25.6	190	4.3	20.0	0.0	None	--	--	--	86.2	110
							E18	18.0	1	43.3	86.2	110
							E36	36.0	2	86.6	133.3	150
							E54	54.0	2	129.9	154.9	175
							E72	72.0	2	173.2	198.2	225
	460-3-60	12.8	95	2.2	10.0	0.0	None	--	--	--	43.2	50
							E18	18.0	1	21.7	43.2	50
							E36	36.0	2	43.3	66.6	70
							E54	54.0	2	65.0	77.5	90
							E72	72.0	2	86.6	99.1	110
	575-3-60	10.2	75	1.7	7.5	0.0	None	--	--	--	33.9	40
							E18	18.0	1	17.3	33.9	40
							E36	36.0	2	34.6	52.7	60
							E54	54.0	2	52.0	61.3	70
							E72	72.0	2	69.3	78.7	90
DH240 (20)	208-3-60	32.1	237	4.5	20.0	0.0	None	--	--	--	101.2	125
							E18	13.5	1	37.5	101.2	125
							E36	27	2	74.9	118.7	125
							E54	40.6	2	112.7	165.9	175
							E72	54.1	2	150.2	175.2	200
	230-3-60	32.1	237	4.3	20.0	0.0	None	--	--	--	100.8	125
							E18	18.0	1	43.3	100.8	125
							E36	36.0	2	86.6	133.3	150
							E54	54.0	2	129.9	154.9	175
							E72	72.0	2	173.2	198.2	225
	460-3-60	14.3	130	2.2	10.0	0.0	None	--	--	--	46.6	60
							E18	18.0	1	21.7	46.6	60
							E36	36.0	2	43.3	66.6	70
							E54	54.0	2	65.0	77.5	90
							E72	72.0	2	86.6	99.1	110
	575-3-60	12.9	85	1.7	7.5	0.0	None	--	--	--	39.9	50
							E18	18.0	1	17.3	39.9	50
							E36	36.0	2	34.6	52.7	60
							E54	54.0	2	52.0	61.3	70
							E72	72.0	2	69.3	78.7	90

NOTE 1: HACR Type per NEC.

TABLE 11: DH 300 ELECTRICAL DATA STANDARD MOTOR WITHOUT POWERED CONVENIENCE OUTLET

MODEL (TON-NAGE)	VOLTAGE	COMPRESSORS		OD FAN MOTORS FLA EACH	ID BLOWER MOTOR FLA	CONV OUTLET AMPS	HEATER OPTION				MIN. CIRCUIT AMPACITY (AMPS)	MAX. FUSE/ BRKR[1] SIZE (AMPS)
		RLA EACH	LRA EACH				MODEL	KW	STAGES	AMPS		
300 (25)	208	37.1	239	4.5	28.0	0.0	None	-	-	-	120.5	150
							E18	13.5	1	37.5	120.5	150
							E36	27.0	2	74.9	128.7	150
							E54	40.6	2	112.7	175.9	200
							E72	54.1	2	150.2	185.2	200
	230	37.1	239	4.3	26.0	0.0	None	-	-	-	118.1	150
							E18	18.0	1	43.3	118.1	150
							E36	36.0	2	86.6	140.8	150
							E54	54.0	2	129.9	162.4	175
							E72	72.0	2	173.2	205.7	225
	460	17.2	125	2.2	13.0	0.0	None	-	-	-	56.1	70
							E18	18.0	1	21.7	56.1	70
							E36	36.0	2	43.3	70.4	80
							E54	54.0	2	65.0	81.2	90
							E72	72.0	2	86.6	102.9	110
	575	12.4	80	1.7	10.0	0.0	None	-	-	-	41.3	50
							E18	18.0	1	17.3	41.3	50
							E36	36.0	2	34.6	55.8	60
							E54	54.0	2	52.0	64.5	70
							E72	72.0	2	69.3	81.8	90

NOTE 1: HACR Type per NEC.

TABLE 12: DH 300 ELECTRICAL DATA HIGH STATIC MOTOR WITHOUT POWERED CONVENIENCE OUTLET

MODEL (TON-NAGE)	VOLTAGE	COMPRESSORS		OD FAN MOTORS FLA EACH	ID BLOWER MOTOR FLA	CONV OUTLET AMPS	HEATER OPTION				MIN. CIRCUIT AMPACITY (AMPS)	MAX. FUSE/ BRKR[1] SIZE (AMPS)
		RLA EACH	LRA EACH				MODEL	KW	STAGES	AMPS		
300 (25)	208	37.1	239	4.5	38.6	0.0	None	-	-	-	131.5	150
							E18	13.5	1	37.5	131.5	150
							E36	27.0	2	74.9	141.9	150
							E54	40.6	2	112.7	189.1	200
							E72	54.1	2	150.2	198.4	225
	230	37.1	239	4.3	38.6	0.0	None	-	-	-	131.1	150
							E18	18.0	1	43.3	131.1	150
							E36	36.0	2	86.6	156.5	175
							E54	54.0	2	129.9	178.2	200
							E72	72.0	2	173.2	221.5	250
	460	17.2	125	2.2	19.3	0.0	None	-	-	-	62.9	80
							E18	18.0	1	21.7	62.9	80
							E36	36.0	2	43.3	78.3	80
							E54	54.0	2	65.0	89.1	100
							E72	72.0	2	86.6	110.7	125
	575	12.4	80	1.7	15.4	0.0	None	-	-	-	47.5	60
							E18	18.0	1	17.3	47.5	60
							E36	36.0	2	34.6	62.6	70
							E54	54.0	2	52.0	71.2	80
							E72	72.0	2	69.3	88.5	100

NOTE 1: HACR Type per NEC.

TABLE 13: DH 180, 210 & 240 ELECTRICAL DATA WITH POWERED CONVENIENCE OUTLET

MODEL (TON-NAGE)	VOLTAGE	COMPRESSORS		OD FAN MOTORS FLA EACH	ID BLOWER MOTOR FLA	CONV OUTLET AMPS	HEATER OPTION				MIN. CIRCUIT AMPACITY (AMPS)	MAX. FUSE/ BRKR[1] SIZE (AMPS)
		RLA EACH	LRA EACH				MODEL	KW	STAGES	AMPS		
DH180 (15)	208-3-60	21.8	184	4.5	12.8	10.0	None	--	--	--	80.9	100
							E18	13.5	1	37.5	80.9	100
							E36	27	2	74.9	122.2	125
							E54	40.6	2	112.7	169.4	175
							E72	54.1	2	150.2	178.7	200
	230-3-60	21.8	184	4.3	12.8	10.0	None	--	--	--	80.5	100
							E18	18.0	1	43.3	82.6	100
							E36	36.0	2	86.6	136.8	150
							E54	54.0	2	129.9	158.4	175
							E72	72.0	2	173.2	201.7	225
	460-3-60	11.0	90	2.2	6.4	5.0	None	--	--	--	40.6	50
							E18	18.0	1	21.7	41.3	50
							E36	36.0	2	43.3	68.4	70
							E54	54.0	2	65.0	79.2	90
							E72	72.0	2	86.6	100.9	110
	575-3-60	9.6	73	1.7	5.2	4.0	None	--	--	--	34.2	40
							E18	18.0	1	17.3	34.2	40
							E36	36.0	2	34.6	54.8	60
							E54	54.0	2	52.0	63.5	70
							E72	72.0	2	69.3	80.8	90
DH210 (17 1/2)	208-3-60	25.6	190	4.5	20.0	10.0	None	--	--	--	96.6	110
							E18	13.5	1	37.5	96.6	110
							E36	27	2	74.9	131.2	150
							E54	40.6	2	112.7	178.4	200
							E72	54.1	2	150.2	187.7	200
	230-3-60	25.6	190	4.3	20.0	10.0	None	--	--	--	96.2	110
							E18	18.0	1	43.3	96.2	110
							E36	36.0	2	86.6	145.8	150
							E54	54.0	2	129.9	167.4	175
							E72	72.0	2	173.2	210.7	225
	460-3-60	12.8	95	2.2	10.0	5.0	None	--	--	--	48.2	60
							E18	18.0	1	21.7	48.2	60
							E36	36.0	2	43.3	72.9	80
							E54	54.0	2	65.0	83.7	90
							E72	72.0	2	86.6	105.4	110
	575-3-60	10.2	75	1.7	7.5	4.0	None	--	--	--	37.9	45
							E18	18.0	1	17.3	37.9	45
							E36	36.0	2	34.6	57.7	60
							E54	54.0	2	52.0	66.3	70
							E72	72.0	2	69.3	83.7	90
DH240 (20)	208-3-60	32.1	237	4.5	20.0	10.0	None	--	--	--	111.2	125
							E18	13.5	1	37.5	111.2	125
							E36	27	2	74.9	131.2	150
							E54	40.6	2	112.7	178.4	200
							E72	54.1	2	150.2	187.7	200
	230-3-60	32.1	237	4.3	20.0	10.0	None	--	--	--	110.8	125
							E18	18.0	1	43.3	110.8	125
							E36	36.0	2	86.6	145.8	150
							E54	54.0	2	129.9	167.4	175
							E72	72.0	2	173.2	210.7	225
	460-3-60	14.3	130	2.2	10.0	5.0	None	--	--	--	51.6	60
							E18	18.0	1	21.7	51.6	60
							E36	36.0	2	43.3	72.9	80
							E54	54.0	2	65.0	83.7	90
							E72	72.0	2	86.6	105.4	110
	575-3-60	12.9	85	1.7	7.5	4.0	None	--	--	--	43.9	50
							E18	18.0	1	17.3	43.9	50
							E36	36.0	2	34.6	57.7	60
							E54	54.0	2	52.0	66.3	70
							E72	72.0	2	69.3	83.7	90

NOTE 1: HACR Type per NEC.

TABLE 14: DH 300 ELECTRICAL DATA STANDARD MOTOR WITH POWERED CONVENIENCE OUTLET

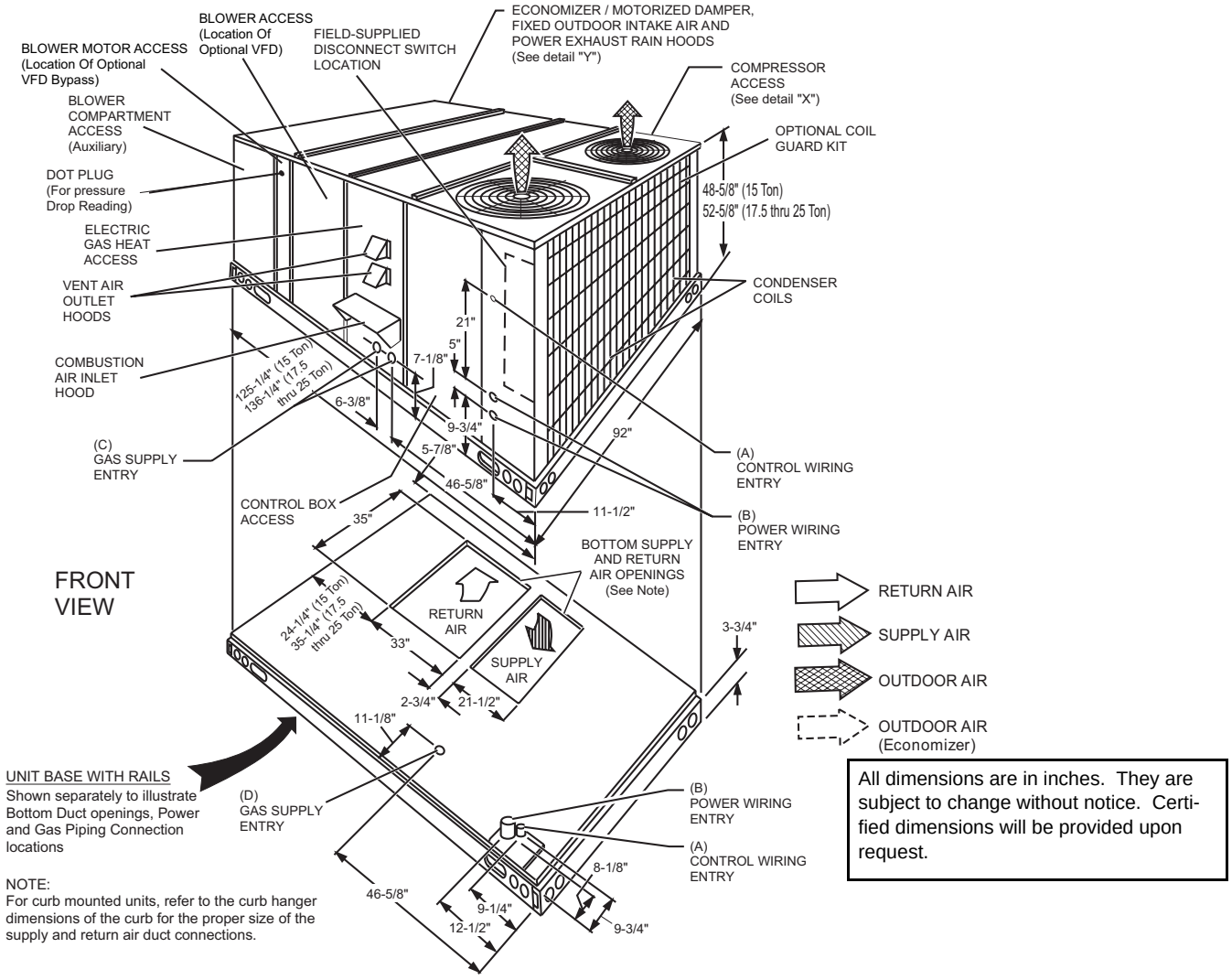
MODEL (TON-NAGE)	VOLTAGE	COMPRESSORS		OD FAN MOTORS FLA EACH	ID BLOWER MOTOR FLA	CONV OUTLET AMPS	HEATER OPTION				MIN. CIRCUIT AMPACITY (AMPS)	MAX. FUSE/ BRKR[1] SIZE (AMPS)
		RLA EACH	LRA EACH				MODEL	KW	STAGES	AMPS		
300 (25)	208	37.1	239	4.5	28.0	10.0	None	-	-	-	130.5	150
							E18	13.5	1	37.5	130.5	150
							E36	27.0	2	74.9	141.2	150
							E54	40.6	2	112.7	188.4	200
							E72	54.1	2	150.2	197.7	200
	230	37.1	239	4.3	26.0	10.0	None	-	-	-	128.1	150
							E18	18.0	1	43.3	128.1	150
							E36	36.0	2	86.6	153.3	175
							E54	54.0	2	129.9	174.9	175
							E72	72.0	2	173.2	218.2	225
	460	17.2	125	2.2	13.0	5.0	None	-	-	-	61.1	70
							E18	18.0	1	21.7	61.1	70
							E36	36.0	2	43.3	76.6	80
							E54	54.0	2	65.0	87.5	90
							E72	72.0	2	86.6	109.1	110
	575	12.4	80	1.7	10.0	4.0	None	-	-	-	45.3	50
							E18	18.0	1	17.3	45.3	50
							E36	36.0	2	34.6	60.8	70
							E54	54.0	2	52.0	69.5	70
							E72	72.0	2	69.3	86.8	90

NOTE 1: HACR Type per NEC.

TABLE 15: DH 300 ELECTRICAL DATA HIGH STATIC MOTOR WITH POWERED CONVENIENCE OUTLET

MODEL (TON-NAGE)	VOLTAGE	COMPRESSORS		OD FAN MOTORS FLA EACH	ID BLOWER MOTOR FLA	CONV OUTLET AMPS	HEATER OPTION				MIN. CIRCUIT AMPACITY (AMPS)	MAX. FUSE/ BRKR[1] SIZE (AMPS)
		RLA EACH	LRA EACH				MODEL	KW	STAGES	AMPS		
300 (25)	208	37.1	239	4.5	38.6	10.0	None	-	-	-	141.5	175
							E18	13.5	1	37.5	141.5	175
							E36	27.0	2	74.9	154.4	175
							E54	40.6	2	112.7	201.6	225
							E72	54.1	2	150.2	210.9	225
	230	37.1	239	4.3	38.6	10.0	None	-	-	-	141.1	175
							E18	18.0	1	43.3	141.1	175
							E36	36.0	2	86.6	169.0	175
							E54	54.0	2	129.9	190.7	225
							E72	72.0	2	173.2	234.0	250
	460	17.2	125	2.2	19.3	5.0	None	-	-	-	67.9	80
							E18	18.0	1	21.7	67.9	80
							E36	36.0	2	43.3	84.5	90
							E54	54.0	2	65.0	95.3	110
							E72	72.0	2	86.6	117.0	125
	575	12.4	80	1.7	15.4	4.0	None	-	-	-	51.5	60
							E18	18.0	1	17.3	51.5	60
							E36	36.0	2	34.6	67.6	70
							E54	54.0	2	52.0	76.2	90
							E72	72.0	2	69.3	93.5	100

NOTE 1: HACR Type per NEC.



All dimensions are in inches. They are subject to change without notice. Certified dimensions will be provided upon request.

UTILITIES ENTRY DATA

HOLE	OPENING SIZE (DIA.)	USED FOR	
A	1-1/8" KO	Control Wiring	Side
	3/4" NPS (Fem.)		Bottom
B	3-5/8" KO	Power Wiring	Side
	3" NPS (Fem.)		Bottom
C	2-3/8" KO	Gas Piping (Front)[1]	
D	1-11/16" Hole	Gas Piping (Bottom)[1, 2]	

1. One-inch gas piping NPT required.
2. Opening in the bottom of the unit can be located by the slice in the insulation.

NOTE: All entry holes should be field sealed to prevent rain water entry into the building.

FIGURE 13 - FRONT VIEW DIMENSIONS

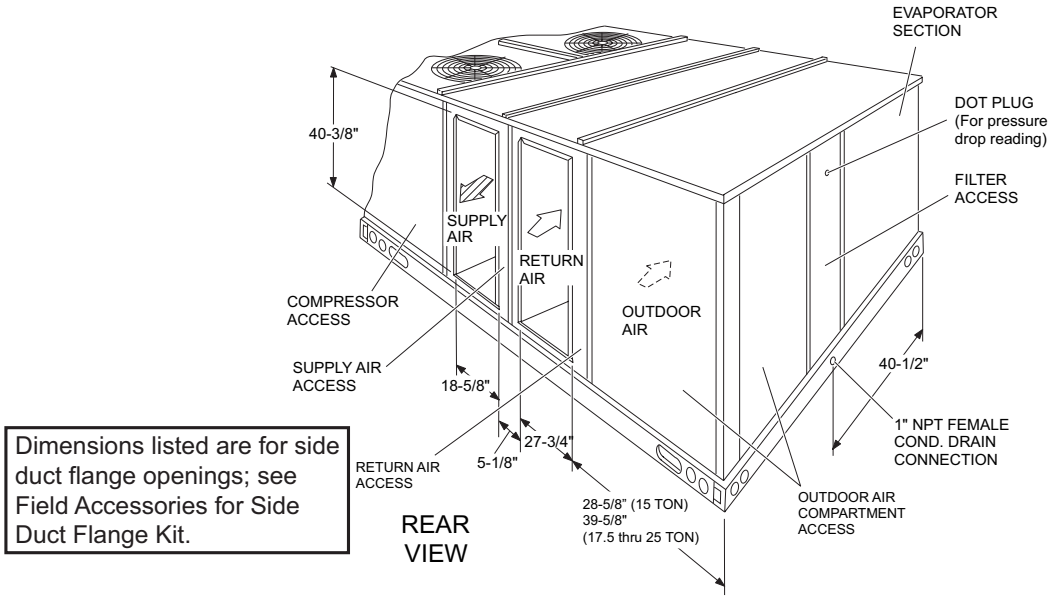


FIGURE 14 - REAR VIEW DIMENSIONS

NOTE: Units are shipped with the bottom duct openings covered. An accessory flange kit is available for connecting side ducts.

For <u>bottom</u> duct applications:

1. Remove the side panels from the supply and return air compartments to gain access to the bottom supply and return air duct covers.
2. Remove and discard the bottom duct covers. Duct openings are closed with sheet metal covers except when the unit includes a power exhaust option. The covering consists of a heavy black paper composition.
3. Replace the side supply and return air compartment panels.

For <u>side</u> duct applications:

1. Replace the side panels on the supply and return air compartments with the side duct flange accessory kit panels.
2. Connect ductwork to the flanges on those panels.

CLEARANCES

LOCATION	CLEARANCE
Front	36”
Rear	24” (Less Economizer) 49” (With Economizer)
Left Side (Filter Access)	24” (Less Economizer) 36” (With Economizer)[3]
Right Side (Cond. Coil)	36”
Below Unit[1]	0”
Above Unit[2]	72” With 36” Maximum Horizontal Overhang (For Condenser Air Discharge)

1. Units may be installed on combustible floors made from wood or class A, B, or C roof covering material.
2. Units must be installed outdoors. Overhanging structures or shrubs should not obstruct condenser air discharge outlet.
3. If economizer is factory installed, the unassembled rain hood must be removed from its ride along position in front of evaporator coil, or in the outdoor air compartment, prior to final installation.

NOTE: ELEC / ELEC Models: Units and ductwork are approved for zero clearance to combustible material when equipped with electric heaters.

GAS / ELEC Models: A 1” clearance must be provided between any combustible material and the supply air ductwork for a distance of 3 feet from the unit.

The products of combustion must not be allowed to accumulate within a confined space and recirculate.

Locate unit so that the vent air outlet hood is at least:

- Three (3) feet above any force air inlet located within 10 horizontal feet (excluding those integral to the unit).
- Four (4) feet below, four horizontal feet from, or one foot above any door or gravity air inlet into the building.
- Four (4) feet from electric and gas meters, regulators and relief equipment.

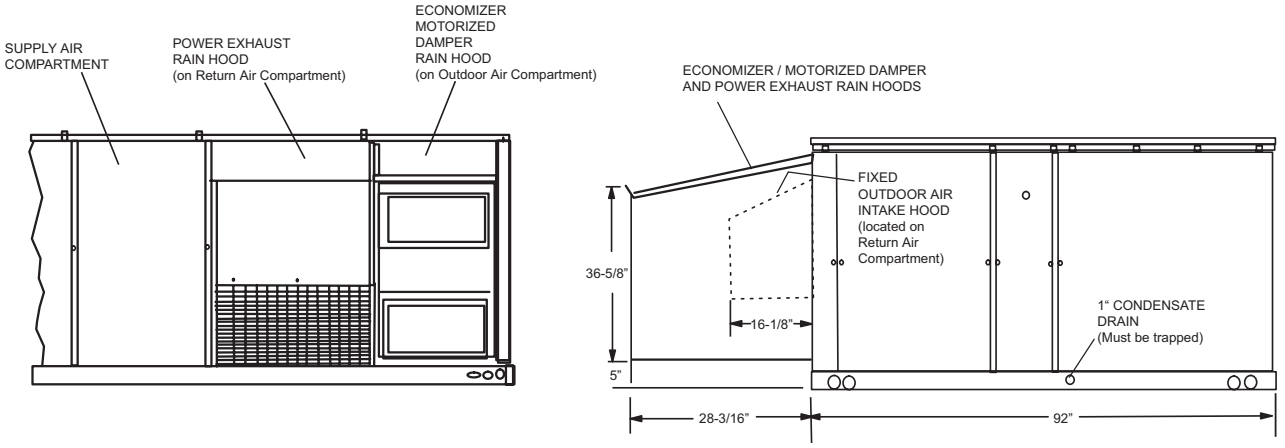

SUPPLY AIR COMPARTMENT
POWER EXHAUST RAIN HOOD (on Return Air Compartment)
ECONOMIZER MOTORIZED DAMPER RAIN HOOD (on Outdoor Air Compartment)
ECONOMIZER / MOTORIZED DAMPER AND POWER EXHAUST RAIN HOODS
FIXED OUTDOOR AIR INTAKE HOOD (located on Return Air Compartment)
36-5/8”
16-1/8”
5”
1“ CONDENSATE DRAIN (Must be trapped)
28-3/16”
92”
REAR VIEW
LH VIEW
DETAIL “Y”
UNIT WITH RAIN HOODS

FIGURE 15 - UNIT CLEARANCES AND RAIN HOOD DIMENSIONS

CFM, STATIC PRESSURE, AND POWER - ALTITUDE AND TEMPERATURE CORRECTIONS

The information below should be used to assist in application of product when being applied at altitudes at or exceeding 1000 feet above sea level.

The air flow rates listed in the standard blower performance tables are based on standard air at sea level. As the altitude or temperature increases, the density of air decreases. In order to use the indoor blower tables for high altitude applications, certain corrections are necessary.

A centrifugal fan is a "constant volume" device. This means that, if the rpm remains constant, the CFM delivered is the same regardless of the density of the air. However, since the air at high altitude is less dense, less static pressure will be generated and less power will be required than a similar application at sea level. Air density correction factors are shown in Table 16 and Figure 16.

TABLE 16: ALTITUDE CORRECTION FACTORS

AIR TEMP	ALTITUDE (FEET)										
	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
40	1.060	1.022	0.986	0.950	0.916	0.882	0.849	0.818	0.788	0.758	0.729
50	1.039	1.002	0.966	0.931	0.898	0.864	0.832	0.802	0.772	0.743	0.715
60	1.019	0.982	0.948	0.913	0.880	0.848	0.816	0.787	0.757	0.729	0.701
70	1.000	0.964	0.930	0.896	0.864	0.832	0.801	0.772	0.743	0.715	0.688
80	0.982	0.947	0.913	0.880	0.848	0.817	0.787	0.758	0.730	0.702	0.676
90	0.964	0.929	0.897	0.864	0.833	0.802	0.772	0.744	0.716	0.689	0.663
100	0.946	0.912	0.880	0.848	0.817	0.787	0.758	0.730	0.703	0.676	0.651

The examples below will assist in determining the airflow performance of the product at altitude.

Example 1: What are the corrected CFM, static pressure, and BHP at an elevation of 5,000 ft. if the blower performance data is 6,000 CFM, 1.5 IWC and 4.0 BHP?

Solution: At an elevation of 5,000 ft the indoor blower will still deliver 6,000 CFM if the rpm is unchanged. However, Table 16 must be used to determine the static pressure and BHP. Since no temperature data is given, we will assume an air temperature of 70°F. Table 16 shows the correction factor to be 0.832.

Corrected static pressure = 1.5 x 0.832 = 1.248 IWC

Corrected BHP = 4.0 x 0.832 = 3.328

Example 2: A system, located at 5,000 feet of elevation, is to deliver 6,000 CFM at a static pressure of 1.5". Use the unit blower tables to select the blower speed and the BHP requirement.

Solution: As in the example above, no temperature information is given so 70°F is assumed.

The 1.5" static pressure given is at an elevation of 5,000 ft. The first step is to convert this static pressure to equivalent sea level conditions.

Sea level static pressure = 1.5 / .832 = 1.80"

Enter the blower table at 6000 sCFM and static pressure of 1.8". The rpm listed will be the same rpm needed at 5,000 ft.

Suppose that the corresponding BHP listed in the table is 3.2. This value must be corrected for elevation.

BHP at 5,000 ft = 3.2 x .832 = 2.66

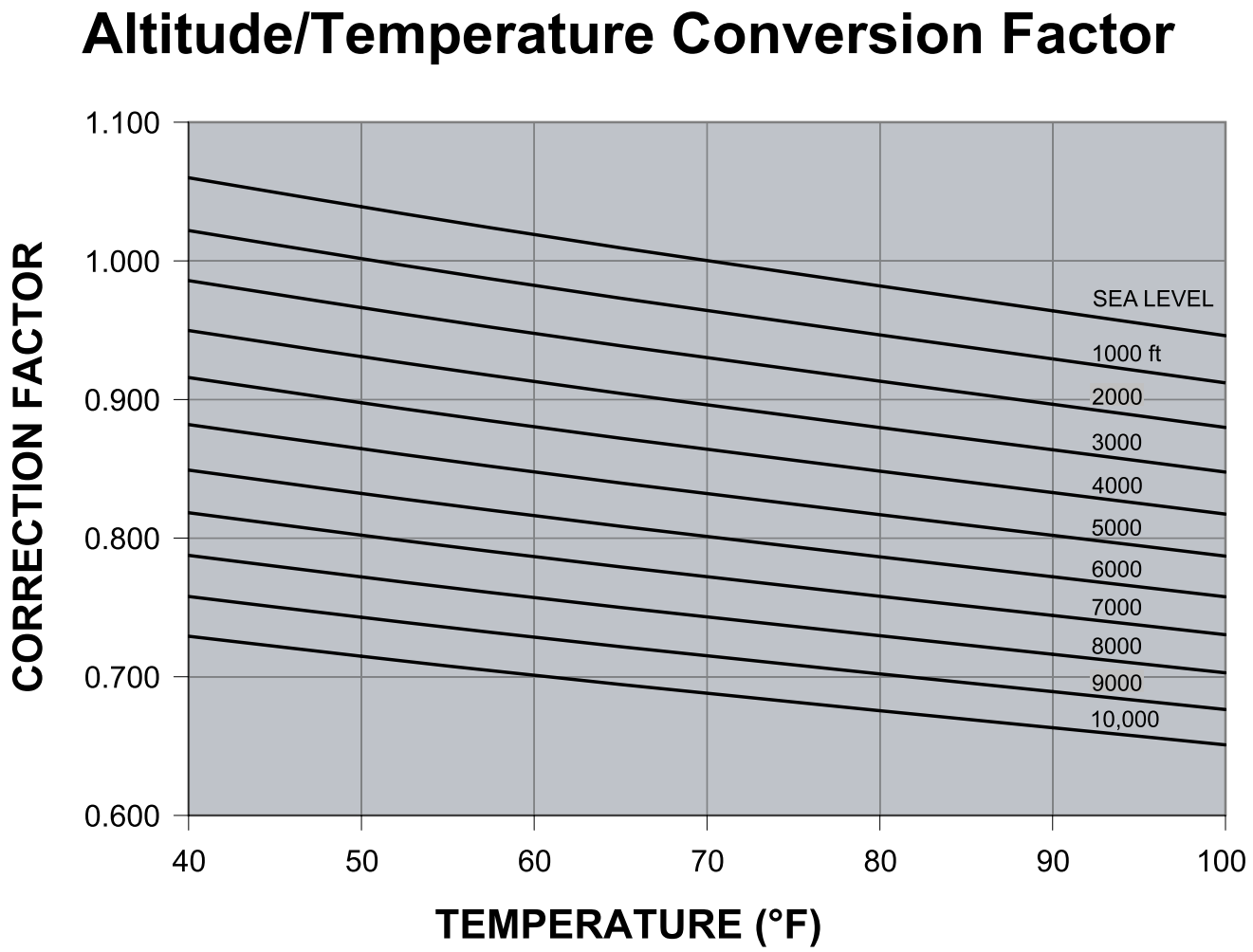


FIGURE 16 - ALTITUDE/TEMPERATURE CONVERSION FACTOR

TABLE 17: SUPPLY AIR BLOWER PERFORMANCE (15 TON) - COOLING ONLY
180 MBH - BOTTOM DUCT CONNECTIONS

BLOWER SPEED, (RPM)	MOTOR PULLEY (TURNS OPEN)*	CFM														
		4500			5250			6000			6750			7200		
		ESP	BHP	KW	ESP	BHP	KW	ESP	BHP	KW	ESP	BHP	KW	ESP	BHP	KW
208 VOLT AND STANDARD DRIVE																
850	6.0**	0.9	2.4	2.2	0.7	3.0	2.7	0.5	3.2	2.9	-	-	-	-	-	-
870	5.5	1.0	2.5	2.3	0.8	3.1	2.8	0.6	3.5	3.1	0.2	4.1	3.7	-	-	-
915	4.5	1.1	2.6	2.4	0.9	3.4	3.0	0.7	3.7	3.3	0.3	4.4	3.9	0.2	4.5	4.0
965	3.5	1.2	2.9	2.6	1.0	3.6	3.2	0.8	4.0	3.6	0.5	4.7	4.2	0.4	4.9	4.4
980	3.0	1.3	3.0	2.7	1.1	3.7	3.3	0.9	4.1	3.7	0.6	4.8.	4.3	0.5	5.1	4.6
1010	2.0	1.4	3.1	2.8	1.2	3.8	3.4	1.0	4.2	3.8	0.7	5.0	4.5	0.6	5.4	4.8
1040	1.0	1.5	3.2	2.9	1.3	3.9	3.5	1.1	4.5	4.0	0.9	5.2	4.7	0.7	5.7	5.1
208 VOLT AND HIGH STATIC DRIVE																
965	6.0	1.2	2.9	2.6	1.0	3.6	3.2	0.8	4.0	3.6	0.5	4.7	4.2	0.4	5.0	4.4
980	5.5	1.3	3.0	2.7	1.1	3.7	3.3	0.9	4.1	3.7	0.6	4.8	4.3	0.5	5.1	4.6
1025	4.5	1.5	3.2	2.9	1.3	3.9	3.5	1.1	4.5	4.0	0.8	5.1	4.6	0.7	5.6	5.0
1065	3.5	1.6	3.4	3.0	1.4	4.0	3.6	1.2	4.7	4.2	1.0	5.5	4.9	-	-	-
1095	3.0	1.7	3.5	3.1	1.5	4.2	3.8	1.3	4.9	4.4	1.2	5.7	5.1	-	-	-
1130	2.0	1.9	3.7	3.3	1.7	4.5	4.0	1.5	5.1	4.6	-	-	-	-	-	-
1170	1.0	2.1	3.9	3.5	2.0	4.7	4.2	1.8	5.5	4.9	-	-	-	-	-	-
230/460/575 VOLT AND STANDARD DRIVE																
870	6.0**	1.0	2.4	2.2	0.8	3.1	2.8	0.6	3.5	3.1	0.2	4.1	3.7	-	-	-
915	5.0	1.1	2.6	2.4	0.9	3.3	3.0	0.7	3.7	3.3	0.3	4.4	3.9	0.2	4.5	4.0
965	4.0	1.2	2.9	2.6	1.0	3.6	3.2	0.8	4.0	3.6	0.5	4.7	4.2	0.4	5.0	4.4
980	3.5	1.3	3.0	2.7	1.1	3.7	3.3	0.9	4.1	3.7	0.6	4.8	4.3	0.5	5.1	4.6
1040	2.0	1.5	3.2	2.9	1.3	3.9	3.5	1.1	4.5	4.0	0.9	5.3	4.7	0.7	5.7	5.1
1065	1.0	1.6	3.3	3.0	1.4	4.0	3.6	1.2	4.7	4.2	1.0	5.5	4.9	-	-	-
230/460/575 VOLT AND HIGH STATIC DRIVE																
980	6.0	1.3	2.9	2.6	1.1	3.7	3.3	0.9	4.1	3.7	0.6	4.8	4.3	0.5	5.1	4.6
1040	4.5	1.5	3.2	2.9	1.3	3.9	3.5	1.1	4.5	4.0	0.9	5.3	4.7	0.7	5.7	5.1
1065	4.0	1.6	3.4	3.0	1.4	4.0	3.6	1.2	4.7	4.2	1.0	5.5	4.9	-	-	-
1095	3.5	1.7	3.5	3.1	1.5	4.2	3.8	1.3	4.9	4.4	1.2	5.7	5.1	-	-	-
1130	2.5	1.9	3.7	3.3	1.7	4.5	4.0	1.5	5.1	4.6	-	-	-	-	-	-
1170	1.5	2.1	3.9	3.5	2.0	4.7	4.2	1.8	5.5	4.9	-	-	-	-	-	-
1190	1.0	2.2	4.0	3.6	2.1	4.8	4.3	2.0	5.7	5.1	-	-	-	-	-	-

NOTES:
1. Blower performance includes fixed outdoor air, 2” T/A filters, a dry evaporator coil and no electric heat.
2. Refer to Table 24 for additional static resistances.
   ESP = External Static Pressure available for the supply and return air duct system. All internal unit resistances have been deducted from the total static pressure of the blower.
   * Do NOT close the pulley below 1 turn open.
   ** Factory setting.

TABLE 18: SUPPLY AIR BLOWER PERFORMANCE (17.5 TON) - COOLING ONLY
210 MBH - BOTTOM DUCT CONNECTIONS

BLOWER SPEED, (RPM)	MOTOR PULLEY (TURNS OPEN)*	CFM											
		6000			7000			8000			9000		
		ESP	BHP	KW	ESP	BHP	KW	ESP	BHP	KW	ESP	BHP	KW
208 VOLT AND STANDARD DRIVE													
870	6.0**	0.4	2.1	1.8	0.1	2.3	2.0	-	-	-	-	-	-
900	5.0	0.8	3.2	2.7	0.5	3.5	2.9	0.2	3.8	3.2	-	-	-
930	4.0	1.1	4.1	3.4	0.9	4.5	3.8	0.6	4.9	4.1	0.1	5.1	4.3
950	3.0	1.3	4.6	3.9	1.1	5.1	4.3	0.8	5.5	4.6	0.4	5.9	5.0
980	2.0	1.6	5.3	4.5	1.4	5.8	4.9	1.2	6.3	5.3	0.7	6.9	5.8
1015	1.0	1.9	5.9	5.0	1.7	6.5	5.5	1.5	7.0	5.9	1.0	7.7	6.5
208 VOLT AND HIGH STATIC DRIVE													
950	6.0	1.3	4.6	3.9	1.1	5.1	4.3	0.8	5.5	4.6	0.4	5.9	5.0
980	5.0	1.6	5.3	4.5	1.4	5.8	4.9	1.2	6.3	5.3	0.7	6.9	5.8
1010	4.0	1.8	5.8	4.9	1.7	6.3	5.3	1.5	6.9	5.8	1.0	7.5	6.3
1020	3.5	1.9	6.1	5.1	1.8	6.5	5.5	1.6	7.1	6.0	1.1	7.8	6.6
1035	3.0	2.0	6.2	5.2	1.9	6.8	5.7	1.7	7.4	6.2	1.2	8.1	6.8
1050	2.5	2.1	6.4	5.4	2.0	7.0	5.9	1.8	7.6	6.4	1.3	8.3	7.0
1075	2.0	2.3	6.6	5.5	2.1	7.2	6.0	1.9	7.8	6.6	1.5	8.6	7.2
1100	1.0	2.4	6.7	5.6	2.2	7.3	6.1	2.1	7.9	6.7	-	-	-
230/460/575 VOLT AND STANDARD DRIVE													
870	6.0**	0.4	2.1	1.8	0.1	2.3	2.0	-	-	-	-	-	-
900	5.0	0.8	3.2	2.7	0.5	3.5	2.9	0.2	3.8	3.2	-	-	-
930	4.0	1.1	4.1	3.4	0.9	4.5	3.8	0.6	4.9	4.1	0.1	5.1	4.3
950	3.5	1.3	4.6	3.9	1.1	5.1	4.3	0.8	5.5	4.6	0.4	5.9	5.0
980	2.5	1.6	5.3	4.5	1.4	5.8	4.9	1.2	6.3	5.3	0.7	6.9	5.8
1015	1.5	1.9	5.9	5.0	1.7	6.5	5.5	1.5	7.0	5.9	1.0	7.7	6.5
1025	1.0	2.0	6.1	5.1	1.8	6.6	5.6	1.6	7.3	6.1	1.1	7.9	6.7
230/460/575 VOLT AND HIGH STATIC DRIVE													
950	6.0	1.3	4.6	3.9	1.1	5.1	4.3	0.8	5.5	4.6	0.4	5.9	5.0
980	5.0	1.6	5.3	4.5	1.4	5.8	4.9	1.2	6.3	5.3	0.7	6.9	5.8
1015	4.0	1.9	5.9	5.0	1.7	6.5	5.5	1.5	7.0	5.9	1.0	7.7	6.5
1035	3.5	2.0	6.2	5.2	1.9	6.8	5.7	1.7	7.4	6.2	1.2	8.1	6.8
1050	3.0	2.1	6.4	5.4	2.0	7.0	5.9	1.8	7.6	6.4	1.3	8.3	7.0
1080	2.0	2.3	6.6	5.5	2.1	7.2	6.0	1.9	7.8	6.6	1.5	8.6	7.2
1100	1.5	2.4	6.7	5.6	2.2	7.3	6.1	2.1	7.9	6.7	-	-	-
1120	1.0	2.5	6.8	5.7	2.3	7.4	6.2	2.2	8.1	6.8	-	-	-

NOTES: 1.Blower performance includes fixed outdoor air, 2” T/A filters, a dry evaporator coil and no electric heat.
2.Refer to Table 13 for additional static resistances.
ESP = External Static Pressure available for the supply and return air duct system. All internal unit resistances have been deducted from the total static pressure of the blower.
* Do NOT close the pulley below 1 turn open.
** Factory setting.

TABLE 19: SUPPLY AIR BLOWER PERFORMANCE (20 TON) - COOLING ONLY
240 MBH - BOTTOM DUCT CONNECTIONS

BLOWER SPEED, (RPM)	MOTOR PULLEY (TURNS OPEN)*	CFM														
		6000			7000			8000			9000			9400		
		ESP	BHP	KW	ESP	BHP	KW	ESP	BHP	KW	ESP	BHP	KW	ESP	BHP	KW
208 VOLT AND STANDARD DRIVE																
870	6.0**	0.4	2.1	1.8	0.1	2.3	2.0	-	-	-	-	-	-	-	-	-
900	5.0	0.8	3.2	2.7	0.5	3.5	2.9	0.2	3.8	3.2	-	-	-	-	-	-
930	4.0	1.1	4.1	3.4	0.9	4.5	3.8	0.6	4.9	4.1	0.1	5.1	4.3	-	-	-
950	3.0	1.3	4.6	3.9	1.1	5.1	4.3	0.8	5.5	4.6	0.4	5.9	5.0	-	-	-
980	2.0	1.6	5.3	4.5	1.4	5.8	4.9	1.2	6.3	5.3	0.7	6.9	5.8	0.2	7.3	6.1
1015	1.0	1.9	5.9	5.0	1.7	6.5	5.5	1.5	7.0	5.9	1.0	7.7	6.5	0.6	8.2	6.9
208 VOLT AND HIGH STATIC DRIVE																
950	6.0	1.3	4.6	3.9	1.1	5.1	4.3	0.8	5.5	4.6	0.4	5.9	5.0	-	-	-
980	5.0	1.6	5.3	4.5	1.4	5.8	4.9	1.2	6.3	5.3	0.7	6.9	5.8	0.2	7.3	6.1
1010	4.0	1.8	5.8	4.9	1.7	6.3	5.3	1.5	6.9	5.8	1.0	7.5	6.3	0.5	7.9	6.7
1020	3.5	1.9	6.1	5.1	1.8	6.5	5.5	1.6	7.1	6.0	1.1	7.8	6.6	0.6	8.3	7.0
1035	3.0	2.0	6.2	5.2	1.9	6.8	5.7	1.7	7.4	6.2	1.2	8.1	6.8	0.7	8.6	7.3
1050	2.5	2.1	6.4	5.4	2.0	7.0	5.9	1.8	7.6	6.4	1.3	8.3	7.0	-	-	-
1075	2.0	2.3	6.6	5.5	2.1	7.2	6.0	1.9	7.8	6.6	1.5	8.6	7.2	-	-	-
1100	1.0	2.4	6.7	5.6	2.2	7.3	6.1	2.1	7.9	6.7	-	-	-	-	-	-
230/460/575 VOLT AND STANDARD DRIVE																
870	6.0**	0.4	2.1	1.8	0.1	2.3	2.0	-	-	-	-	-	-	-	-	-
900	5.0	0.8	3.2	2.7	0.5	3.5	2.9	0.2	3.8	3.2	-	-	-	-	-	-
930	4.0	1.1	4.1	3.4	0.9	4.5	3.8	0.6	4.9	4.1	0.1	5.1	4.3	-	-	-
950	3.5	1.3	4.6	3.9	1.1	5.1	4.3	0.8	5.5	4.6	0.4	5.9	5.0	-	-	-
980	2.5	1.6	5.3	4.5	1.4	5.8	4.9	1.2	6.3	5.3	0.7	6.9	5.8	0.2	7.3	6.1
1015	1.5	1.9	5.9	5.0	1.7	6.5	5.5	1.5	7.0	5.9	1.0	7.7	6.5	0.6	8.2	6.9
1025	1.0	2.0	6.1	5.1	1.8	6.6	5.6	1.6	7.3	6.1	1.1	7.9	6.7	0.7	8.6	7.3
230/460/575 VOLT AND HIGH STATIC DRIVE																
950	6.0	1.3	4.6	3.9	1.1	5.1	4.3	0.8	5.5	4.6	0.4	5.9	5.0	-	-	-
980	5.0	1.6	5.3	4.5	1.4	5.8	4.9	1.2	6.3	5.3	0.7	6.9	5.8	0.2	7.3	6.1
1015	4.0	1.9	5.9	5.0	1.7	6.5	5.5	1.5	7.0	5.9	1.0	7.7	6.5	0.6	8.2	6.9
1035	3.5	2.0	6.2	5.2	1.9	6.8	5.7	1.7	7.4	6.2	1.2	8.1	6.8	0.7	8.6	7.3
1050	3.0	2.1	6.4	5.4	2.0	7.0	5.9	1.8	7.6	6.4	1.3	8.3	7.0	-	-	-
1080	2.0	2.3	6.6	5.5	2.1	7.2	6.0	1.9	7.8	6.6	1.5	8.6	7.2	-	-	-
1100	1.5	2.4	6.7	5.6	2.2	7.3	6.1	2.1	7.9	6.7	-	-	-	-	-	-
1120	1.0	2.5	6.8	5.7	2.3	7.4	6.2	2.2	8.1	6.8	-	-	-	-	-	-

NOTES:
1. Blower performance includes fixed outdoor air, 2” T/A filters, a dry evaporator coil and no electric heat.
2. Refer to Table 24 for additional static resistances.
   ESP = External Static Pressure available for the supply and return air duct system. All internal unit resistances have been deducted from the total static pressure of the blower.
   * Do NOT close the pulley below 1 turn open.
   ** Factory setting.

TABLE 20: SUPPLY AIR BLOWER PERFORMANCE (15 TON) - GAS HEAT
180 MBH - BOTTOM DUCT CONNECTIONS

BLOWER SPEED, (RPM)	MOTOR PULLEY (TURNS OPEN)*	CFM														
		4500			5250			6000			6750			7200		
		ESP	BHP	KW	ESP	BHP	KW	ESP	BHP	KW	ESP	BHP	KW	ESP	BHP	KW
208 VOLT AND STANDARD DRIVE																
850	6.0**	0.9	2.4	2.1	0.6	2.9	2.6	0.3	3.4	3.0	-	-	-	-	-	-
870	5.5	1.0	2.5	2.2	0.7	3.0	2.7	0.4	3.5	3.1	-	-	-	-	-	-
915	4.5	1.1	2.6	2.4	0.8	3.1	2.8	0.5	3.6	3.2	0.2	4.1	3.7	-	-	-
965	3.5	1.2	2.7	2.5	0.9	3.2	2.9	0.6	3.7	3.3	0.4	4.4	3.0	0.2	5.0	4.5
980	3.0	1.3	2.9	2.6	1.0	3.4	3.0	0.7	3.8	3.4	0.5	4.5	4.0	0.3	5.1	4.6
1010	2.0	1.4	3.0	2.7	1.1	3.6	3.2	0.8	4.0	3.6	0.6	4.7	4.2	0.4	5.4	4.8
1040	1.0	1.6	3.2	2.9	1.3	3.8	3.4	1.0	4.4	3.9	0.8	5.0	4.5	0.6	5.6	5.0
208 VOLT AND HIGH STATIC DRIVE																
965	6.0	1.2	2.7	2.5	0.9	3.2	2.9	0.6	3.7	3.3	0.4	4.4	3.9	0.2	5.0	4.5
980	5.5	1.3	2.9	2.6	1.0	3.4	3.0	0.7	3.8	3.4	0.5	4.5	4.0	0.3	5.1	4.6
1025	4.5	1.4	3.1	2.8	1.2	3.6	3.2	0.9	4.1	3.7	0.7	4.8	4.3	0.4	5.5	4.9
1065	3.5	1.6	3.4	3.0	1.4	3.9	3.5	1.1	4.5	4.0	0.9	5.1	4.6	-	-	-
1125	2.0	1.9	3.6	3.2	1.7	4.4	3.9	1.4	5.0	4.5	1.2	5.8	5.2	-	-	-
1170	1.0	2.1	3.9	3.5	1.9	4.7	4.2	1.6	5.5	4.9	-	-	-	-	-	-
230/460/575 VOLT AND STANDARD DRIVE																
870	6.0**	1.0	2.5	2.2	0.7	3.0	2.7	0.4	3.5	3.1	-	-	-	-	-	-
915	5.0	1.1	2.6	2.4	0.8	3.1	2.8	0.5	3.6	3.2	0.2	4.1	3.7	-	-	-
965	4.0	1.2	2.7	2.5	0.9	3.2	2.9	0.6	3.7	3.3	0.4	4.4	3.9	0.2	5.0	4.5
980	3.5	1.3	2.9	2.6	1.0	3.4	3.0	0.7	3.8	3.4	0.5	4.5	4.0	0.3	5.1	4.6
1015	2.5	1.4	3.0	2.7	1.1	3.6	3.2	0.8	4.0	3.6	0.6	4.7	4.2	0.4	5.4	4.8
1050	1.5	1.5	3.1	2.8	1.2	3.7	3.3	0.9	4.2	3.8	0.7	4.9	4.4	0.5	5.7	5.1
1065	1.0	1.6	3.4	3.0	1.4	3.9	3.5	1.1	4.5	4.0	0.9	5.1	4.6	-	-	-
230/460/575 VOLT AND HIGH STATIC DRIVE																
980	6.0	1.3	2.9	2.6	1.0	3.4	3.0	0.7	3.8	3.4	0.5	4.5	4.0	0.3	5.1	4.6
1045	4.5	1.6	3.2	2.9	1.3	3.8	3.4	1.0	4.4	3.9	0.8	5.0	4.5	0.6	5.6	5.0
1065	4.0	1.7	3.4	3.0	1.4	3.9	3.5	1.1	4.5	4.0	0.9	5.1	4.6	-	-	-
1125	2.5	1.9	3.6	3.2	1.7	4.4	3.9	1.4	5.0	4.5	1.2	5.8	5.2	-	-	-
1170	1.5	2.1	3.9	3.5	1.8	4.7	4.2	1.6	5.5	4.9	-	-	-	-	-	-
1190	1.0	2.2	4.0	3.6	1.9	4.8	4.3	1.7	5.6	5.0	-	-	-	-	-	-

NOTES:
1. Blower performance includes a gas-fired heat exchanger, fixed outdoor air, two-inch T/A filters and a dry evaporator coil.
2. Refer to the additional Static Resistances table.
   ESP = External Static Pressure available for the supply and return air duct system. All internal unit resistances have been deducted from the total static pressure of the blower.
   * Do NOT close the pulley below 1 turn open.
   ** Factory setting.

TABLE 21: SUPPLY AIR BLOWER PERFORMANCE (17.5 TON) - GAS HEAT 210 MBH - BOTTOM DUCT CONNECTIONS

BLOWER SPEED, (RPM)	MOTOR PULLEY (TURNS OPEN)*	CFM											
		6000			7000			8000			9000		
		ESP	BHP	KW	ESP	BHP	KW	ESP	BHP	KW	ESP	BHP	KW
208 VOLT AND STANDARD DRIVE													
870	6.0**	1.3	3.6	3.0	0.7	4.3	3.7	0.2	5.1	4.3	-	-	-
900	5.0	1.4	3.8	3.2	0.9	4.7	4.0	0.4	5.6	4.7	-	-	-
930	4.0	1.6	4.1	3.4	1.1	5.0	4.2	0.6	5.9	5.0	0.1	6.7	5.7
950	3.0	1.7	4.2	3.6	1.3	5.1	4.3	0.8	6.0	5.1	0.2	6.9	5.8
980	2.0	1.9	4.5	3.8	1.5	5.4	4.5	1.0	6.3	5.3	0.4	7.2	6.1
995	1.5	2.1	4.6	3.9	1.6	5.5	4.7	1.1	6.4	5.4	0.5	7.5	6.3
1015	1.0	2.2	4.8	4.0	1.7	4.7	4.8	1.2	6.6	5.6	0.7	7.8	6.6
208 VOLT AND HIGH STATIC DRIVE													
950	6.0	1.7	4.2	3.6	1.3	5.1	4.3	0.8	6.0	5.1	0.2	6.9	5.8
980	5.0	1.9	4.5	3.8	1.5	5.4	4.5	1.0	6.3	5.3	0.4	7.2	6.1
995	4.5	2.1	4.5	3.9	1.6	5.5	4.7	1.1	6.4	5.4	0.5	7.5	6.3
1025	3.5	2.3	4.9	4.1	1.8	5.8	4.9	1.3	6.7	5.7	0.7	8.0	6.7
1050	2.5	2.5	5.1	4.3	2.0	6.1	5.1	1.4	7.1	6.0	0.9	8.4	7.0
1065	2.0	2.6	5.3	4.4	2.1	6.3	5.3	1.5	7.3	6.2	1.0	8.6	7.2
1100	1.0	2.9	5.6	4.7	2.3	6.8	5.7	1.8	7.9	6.6	-	-	-
230/460/575 VOLT AND STANDARD DRIVE													
870	6.0**	1.3	3.6	3.0	0.7	4.3	3.7	0.2	5.1	4.3	-	-	-
900	5.0	1.4	3.8	3.2	0.9	4.7	4.0	0.4	5.6	4.7	-	-	-
930	4.0	1.6	4.1	3.4	1.1	5.0	4.2	0.6	5.9	5.0	0.1	6.7	5.7
950	3.5	1.7	4.2	3.6	1.3	5.1	4.3	0.8	6.0	5.1	0.2	6.9	5.8
965	2.5	1.9	4.5	3.8	1.5	5.4	4.5	1.0	6.3	5.3	0.4	7.2	6.1
995	2.0	2.1	4.6	3.9	1.6	5.5	4.7	1.1	6.4	5.4	0.5	7.5	6.3
1015	1.5	2.2	4.8	4.0	1.7	5.7	4.8	1.2	6.6	5.6	0.6	7.8	6.6
1025	1.0	2.3	4.9	4.1	1.8	5.8	4.9	1.3	6.7	5.7	0.7	8.0	6.7
230/460/575 VOLT AND HIGH STATIC DRIVE													
950	6.0	1.7	4.2	3.6	1.3	5.1	4.3	0.8	6.0	5.1	0.2	6.9	5.8
980	5.0	1.9	4.5	3.8	1.5	5.4	4.5	1.0	6.3	5.3	0.4	7.2	6.1
995	4.5	2.1	4.6	3.9	1.6	5.5	4.7	1.1	6.4	5.4	0.5	7.5	6.3
1015	4.0	2.2	4.8	4.0	1.7	5.7	4.8	1.2	6.6	5.6	0.6	7.8	6.6
1025	3.5	2.3	4.9	4.1	1.8	5.8	4.9	1.3	6.7	5.7	0.7	8.0	6.7
1050	3.0	2.5	5.1	4.3	2.0	6.1	5.1	1.4	7.1	6.0	0.9	8.4	7.0
1065	2.5	2.6	5.3	4.4	2.1	6.3	5.3	1.5	7.3	6.2	1.0	8.6	7.2
1100	1.5	2.9	5.6	4.7	2.3	6.8	4.7	1.8	7.9	6.6	-	-	-
1120	1.0	3.1	5.8	4.9	2.5	7.0	5.9	1.9	8.3	6.9	-	-	-

NOTES:
1. Blower performance includes a gas-fired heat exchanger, fixed outdoor air, two-inch T/A filters and a dry evaporator coil.
2. Refer to the additional Static Resistances table.
   ESP = External Static Pressure available for the supply and return air duct system. All internal unit resistances have been deducted from the total static pressure of the blower.
   * Do NOT close the pulley below 1 turn open.
   ** Factory setting.

TABLE 22: SUPPLY AIR BLOWER PERFORMANCE (20 TON) - GAS HEAT 240 MBH - BOTTOM DUCT CONNECTIONS

BLOWER SPEED, (RPM)	MOTOR PULLEY (TURNS OPEN)*	CFM														
		6000			7000			8000			9000			9400		
		ESP	BHP	KW	ESP	BHP	KW	ESP	BHP	KW	ESP	BHP	KW	ESP	BHP	KW
208 VOLT AND STANDARD DRIVE																
870	6.0**	1.3	3.6	3.0	0.7	4.3	3.7	0.2	5.1	4.3	-	-	-	-	-	-
900	5.0	1.4	3.8	3.2	0.9	4.7	4.0	0.4	5.6	4.7	-	-	-	-	-	-
930	4.0	1.6	4.1	3.4	1.1	5.0	4.2	0.6	5.9	5.0	0.1	6.7	5.7	-	-	-
950	3.0	1.7	4.2	3.6	1.3	5.1	4.3	0.8	6.0	5.1	0.2	6.9	5.8	-	-	-
980	2.0	1.9	4.5	3.8	1.5	5.4	4.5	1.0	6.3	5.3	0.4	7.2	6.1	0.1	8.5	7.1
995	1.5	2.1	4.6	3.9	1.6	5.5	4.7	1.1	6.4	5.4	0.5	7.5	6.3	0.2	8.6	7.3
1015	1.0	2.2	4.8	4.0	1.7	4.7	4.8	1.2	6.6	5.6	0.7	7.8	6.6	-	-	-
208 VOLT AND HIGH STATIC DRIVE																
950	6.0	1.7	4.2	3.6	1.3	5.1	4.3	0.8	6.0	5.1	0.2	6.9	5.8	-	-	-
980	5.0	1.9	4.5	3.8	1.5	5.4	4.5	1.0	6.3	5.3	0.4	7.2	6.1	0.1	8.5	7.1
995	4.5	2.1	4.5	3.9	1.6	5.5	4.7	1.1	6.4	5.4	0.5	7.5	6.3	0.2	8.6	7.3
1025	3.5	2.3	4.9	4.1	1.8	5.8	4.9	1.3	6.7	5.7	0.7	8.0	6.7	-	-	-
1050	2.5	2.5	5.1	4.3	2.0	6.1	5.1	1.4	7.1	6.0	0.9	8.4	7.0	-	-	-
1065	2.0	2.6	5.3	4.4	2.1	6.3	5.3	1.5	7.3	6.2	1.0	8.6	7.2	-	-	-
1100	1.0	2.9	5.6	4.7	2.3	6.8	5.7	1.8	7.9	6.6	-	-	-	-	-	-
230/460/575 VOLT AND STANDARD DRIVE																
870	6.0**	1.3	3.6	3.0	0.7	4.3	3.7	0.2	5.1	4.3	-	-	-	-	-	-
900	5.0	1.4	3.8	3.2	0.9	4.7	4.0	0.4	5.6	4.7	-	-	-	-	-	-
930	4.0	1.6	4.1	3.4	1.1	5.0	4.2	0.6	5.9	5.0	0.1	6.7	5.7	-	-	-
950	3.5	1.7	4.2	3.6	1.3	5.1	4.3	0.8	6.0	5.1	0.2	6.9	5.8	-	-	-
965	2.5	1.9	4.5	3.8	1.5	5.4	4.5	1.0	6.3	5.3	0.4	7.2	6.1	0.1	8.5	7.1
995	2.0	2.1	4.6	3.9	1.6	5.5	4.7	1.1	6.4	5.4	0.5	7.5	6.3	0.2	8.6	7.3
1015	1.5	2.2	4.8	4.0	1.7	5.7	4.8	1.2	6.6	5.6	0.6	7.8	6.6	-	-	-
1025	1.0	2.3	4.9	4.1	1.8	5.8	4.9	1.3	6.7	5.7	0.7	8.0	6.7	-	-	-
230/460/575 VOLT AND HIGH STATIC DRIVE																
950	6.0	1.7	4.2	3.6	1.3	5.1	4.3	0.8	6.0	5.1	0.2	6.9	5.8	-	-	-
980	5.0	1.9	4.5	3.8	1.5	5.4	4.5	1.0	6.3	5.3	0.4	7.2	6.1	0.1	8.5	7.1
995	4.5	2.1	4.6	3.9	1.6	5.5	4.7	1.1	6.4	5.4	0.5	7.5	6.3	0.2	8.6	7.3
1015	4.0	2.2	4.8	4.0	1.7	5.7	4.8	1.2	6.6	5.6	0.6	7.8	6.6	-	-	-
1025	3.5	2.3	4.9	4.1	1.8	5.8	4.9	1.3	6.7	5.7	0.7	8.0	6.7	-	-	-
1050	3.0	2.5	5.1	4.3	2.0	6.1	5.1	1.4	7.1	6.0	0.9	8.4	7.0	-	-	-
1065	2.5	2.6	5.3	4.4	2.1	6.3	5.3	1.5	7.3	6.2	1.0	8.6	7.2	-	-	-
1100	1.5	2.9	5.6	4.7	2.3	6.8	4.7	1.8	7.9	6.6	-	-	-	-	-	-
1120	1.0	3.1	5.8	4.9	2.5	7.0	5.9	1.9	8.3	6.9	-	-	-	-	-	

NOTES:
1. Blower performance includes a gas-fired heat exchanger, fixed outdoor air, two-inch T/A filters and a dry evaporator coil.
2. Refer to the additional Static Resistances table.
   ESP = External Static Pressure available for the supply and return air duct system. All internal unit resistances have been deducted from the total static pressure of the blower.
   * Do NOT close the pulley below 1 turn open.
   ** Factory setting.

TABLE 23: SUPPLY AIR BLOWER PERFORMANCE (25 TON) - GAS HEAT
300 MBH - BOTTOM DUCT CONNECTIONS

BLOWER SPEED, (RPM)	MOTOR PULLEY (TURNS OPEN)*	CFM														
		7500			8750			10000			11250			12500		
		ESP	BHP	KW	ESP	BHP	KW	ESP	BHP	KW	ESP	BHP	KW	ESP	BHP	KW
208 VOLT AND STANDARD DRIVE																
975	6.0	1.2	5.9	4.9	5.0	7.3	6.0	-	-	-	-	-	-	-	-	-
1005	5.0	1.4	6.2	5.1	0.7	7.7	6.3	-	-	-	-	-	-	-	-	-
1040	4.0	1.6	6.6	5.4	0.9	8.1	6.7	0.2	9.7	8.0	-	-	-	-	-	-
1070	3.0	1.8	6.9	5.7	1.1	8.5	7.0	0.4	10.2	8.3	-	-	-	-	-	-
1100	2.0	2.0	7.3	6.0	1.3	8.9	7.3	0.6	10.6	8.7	-	-	-	-	-	-
1135	1.0	2.2	7.7	6.3	1.6	9.3	7.6	0.8	11.1	9.1	-	-	-	-	-	-
1165	0.0	2.4	8.0	6.6	1.8	9.7	8.0	1.0	11.6	9.5	0.2	13.5	11.0	-	-	-
208 VOLT AND HIGH STATIC DRIVE																
1140	6.0	2.2	7.7	6.3	1.6	9.4	7.7	0.9	11.2	9.2	-	-	-	-	-	-
1180	5.0	2.5	8.2	6.7	1.9	9.9	8.1	1.2	11.8	9.7	0.3	13.7	11.2	-	-	-
1215	4.0	2.7	8.6	7.0	2.1	10.4	8.5	1.4	12.3	10.1	0.6	14.3	11.7	-	-	-
1255	3.0	3.0	9.1	7.4	2.4	11.0	9.0	1.7	12.9	10.6	0.9	15.0	12.3	-	-	-
1290	2.0	3.2	9.5	7.8	2.7	11.5	9.4	2.0	13.5	11.1	1.2	15.6	12.8	-	-	-
1330	1.0	3.5	10.0	8.2	3.0	12.0	9.9	2.3	14.1	11.6	1.5	16.4	13.4	-	-	-
1365	0.0	3.7	10.5	8.6	3.2	12.6	10.3	2.6	14.7	12.1	1.8	17.0	13.9	-	-	-
230/460/575 VOLT AND STANDARD DRIVE																
975	6.0*	1.4	5.9	4.9	1.0	7.3	6.0	0.5	8.8	7.2	-	-	-	-	-	-
1005	5.0	1.6	6.2	5.1	1.2	7.7	6.3	0.7	9.2	7.6	0.1	10.9	8.9	-	-	-
1040	4.0	1.8	6.6	5.4	1.4	8.1	6.7	0.9	9.7	8.0	0.3	11.4	9.4	-	-	-
1070	3.0	2.0	6.9	5.7	1.6	8.5	7.0	1.1	10.2	8.3	0.6	11.9	9.8	-	-	-
1100	2.0	2.1	7.3	6.0	1.8	8.9	7.3	1.3	10.6	8.7	0.8	12.4	10.2	0.2	14.3	11.7
1135	1.0	2.4	7.7	6.3	2.0	9.3	7.6	1.6	11.1	9.1	1.0	13.0	10.6	0.4	14.9	12.2
1165	0.0	2.6	8.0	6.6	2.2	9.7	8.0	1.8	11.6	9.5	1.3	13.5	11.0	0.7	15.5	12.7
230/460/575 VOLT AND HIGH STATIC DRIVE																
1140	6.0	2.4	7.7	6.3	2.1	9.4	7.7	1.6	11.2	9.2	1.1	13.1	10.7	0.5	15.0	12.3
1180	5.0	2.7	8.2	6.7	2.3	9.9	8.1	1.9	11.8	9.7	1.4	13.7	11.2	0.8	15.8	12.9
1215	4.0	2.9	8.6	7.0	2.6	10.4	8.5	2.2	12.3	10.1	1.7	14.3	11.7	1.1	16.4	13.5
1255	3.0	3.2	9.1	7.4	2.9	11.0	9.0	2.5	12.9	10.6	2.0	15.0	12.3	1.4	17.2	14.1
1290	2.0	3.4	9.5	7.8	3.1	11.5	9.4	2.7	13.5	11.1	2.2	15.6	12.8	-	-	-
1330	1.0	3.7	10.0	8.2	3.4	12.0	9.9	3.0	14.1	11.6	2.6	16.4	13.4	-	-	-
1365	0.0	3.9	10.5	8.6	3.7	12.6	10.3	3.3	14.7	12.1	2.9	17.0	13.9	-	-	-

NOTES:
1. Blower performance includes a gas-fired heat exchanger, fixed outdoor air, two-inch T/A filters and a dry evaporator coil.
2. Refer to the additional Static Resistances table.

ESP = External Static Pressure available for the supply and return air duct system. All internal unit resistances have been deducted from the total static pressure of the blower.

* Do NOT close the pulley below 1 turn open.

** Factory setting.

15 HP Motor is required.

TABLE 24:STATIC RESISTANCES[1]

DESCRIPTION		RESISTANCE, IWG											
		CFM											
		15 TON			17.5 TON			20 TON			25 TON		
		4500	6000	7200	6000	8000	9000	6000	7000	9400	7500	10000	12500
WET COIL		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
ELECTRIC HEAT OPTIONS (DH models only)	18kW	0.3	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.5	0.4	0.6	0.6
	36kW	0.3	0.4	0.5	0.4	0.5	0.5	0.4	0.5	0.5	0.5	0.5	0.6
	54kW	0.4	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.6	0.7
	72kW	0.4	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.6	0.7
ECONOMIZER OPTION		0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.2	0.3
HORIZONTAL DUCT CONNECTIONS[2]		0.1	0.2	0.3	0.2	0.3	0.5	0.2	0.3	0.5	0.3	0.5	0.6

1. Deduct theses resistance values from the available unit ESP values listed in the respective blower performance table except for Horizontal Duct Connections.
2. Since the resistance to air flow will be less for horizontal duct connections than for bottom duct connections, add these pressures to the ESP values on the respective unit's blower performance table.

TABLE 25: POWER EXHAUST PERFORMANCE

MOTOR SPEED	STATIC RESISTANCE OF RETURN DUCTWORK, IWG									
	0.2		0.3		0.4		0.5		0.6	
	CFM	KW	CFM	KW	CFM	KW	CFM	KW	CFM	KW
HIGH*	5250	0.83	4500	0.85	4200	0.88	3750	0.93	3000	0.99
MEDIUM	4900	0.77	3900	0.79	3500	0.82	2900	0.85	-	-
LOW	4400	0.72	3700	0.74	3000	0.78	-	-	-	-

* Factory Setting
Power Exhaust motor is a 3/4 HP, PSC type with sleeve bearings, a 48 frame and inherent protection.

TABLE 26: BLOWER MOTOR AND DRIVE DATA

MODEL SIZE	DRIVE	BLOWER RANGE (RPM)	MOTOR[1]			ADJUSTABLE MOTOR PULLEY				FIXED BLOWER PULLEY				BELT (NOTCHED)		
			HP	FRAME	EFF. (%)	DESIG-NATION	OUTSIDE DIA. (IN.)	PITCH DIA. (IN.)	BORE (IN.)	DESIG-NATION	OUTSIDE DIA. (IN.)	PITCH DIA. (IN.)	BORE (IN.)	DESIG-NATION	PITCH LENGTH (IN.)	QTY.
15 TON	Standard	850/1065	5	184 T	83	1VP56	5.35	4.3-5.3[2]	1-1/8	BK90	8.75	8.4	1	BX70	82.8	1
	High Static	965/1190								BK80	7.75	7.4	1	BX68	69.8	1
17.5 & 20 TON	Standard	870/1025	7.5	213 T	89	1VP68	6.75	5.5-6.5[2]	1-3/8	BK120	11.75	11.4	1-3/16	BX83	84.8	1
	High Static	950/1120								BK110	10.75	10.4	1-3/16	BX81	82.8	1
25 TON	Standard	950/1120	10	215 T	89.5	1VP68	6.75	5.5-6.5[2]	1-3/8	1B5V110	11.3	11.1	1-7/16	BX81	82.8	1
	High Static	1140/1365	15	254 T	91	1VP75X	7.5	6.2-7.4	1-5/8	1B5V94	9.7	9.5	1-7/16	5VX840	84.0	1

1. All motors have a nominal speed of 1800 RPM, a 1.15 service factor and a solid base. They can operate to the limit of their service factor because they are located in the moving air, upstream of any heating device.
2. Do NOT close this pulley below 1 turn open.

PHASING

YORK® MODEL DH, units are properly phased at the factory. Check for proper compressor rotation. If the blower or compressors rotate in the wrong direction at start-up, the electrical connection to the unit is misphased. Change the incoming line connection phasing to obtain proper rotation. (Scroll compressors operate in only one direction. If the scroll is drawing low amperage, has similar suction and discharge pressures, or producing a high noise level, the scroll is misphased).

⚠ CAUTION

Scroll compressors require proper rotation to operate correctly. Units are properly phased at the factory. Do not change the internal wiring to make the blower, condenser fans, or compressor rotate correctly.

CHECKING SUPPLY AIR CFM

The RPM of the supply air blower will depend on the required CFM, the unit accessories or options and the static resistances of both the supply and the return air duct systems. With this information, the RPM for the supply air blower and the motor pulley adjustment (turns open) can be determined from the Blower Performance Data Tables.

High speed drive accessories (containing a smaller blower pulley and a shorter belt) are available for applications requiring the supply air blower to produce higher CFM's and/or higher static pressures. Use Model 1LD0416 for 15 ton units and Model 1LD0417 for 20 ton units. Refer to the Blower Motor and Drive Data Table 26.

Note the following:

1. The supply air CFM must be within the limitations shown in the Unit Application Data Table 1.
2. Pulleys can be adjusted in half turn increments.
3. The tension on the belt should be adjusted as shown in the Belt Adjustment Figure 17.

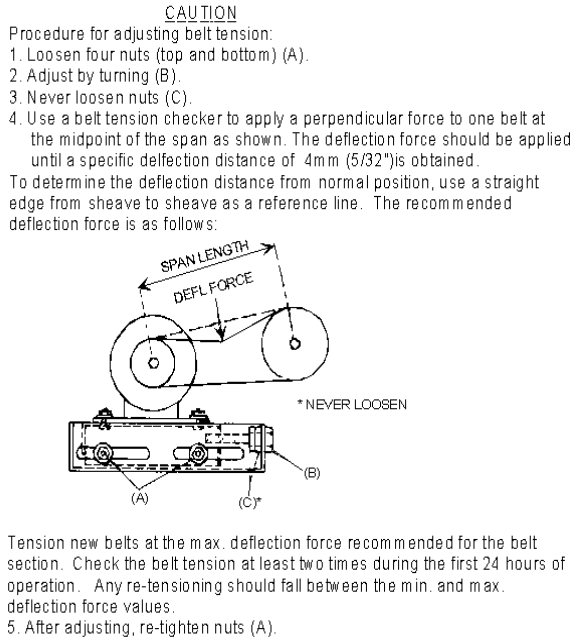

CAUTION
Procedure for adjusting belt tension:
1. Loosen four nuts (top and bottom) (A).
2. Adjust by turning (B).
3. Never loosen nuts (C).
4. Use a belt tension checker to apply a perpendicular force to one belt at the midpoint of the span as shown. The deflection force should be applied until a specific delfection distance of 4mm (5/32")is obtained.
To determine the deflection distance from normal position, use a straight edge from sheave to sheave as a reference line. The recommended deflection force is as follows:
SPAN LENGTH
DEFL FORCE
* NEVER LOOSEN
(B)
(A)
(C)*
Tension new belts at the max. deflection force recommended for the belt section. Check the belt tension at least two times during the first 24 hours of operation. Any re-tensioning should fall between the min. and max. deflection force values.
5. After adjusting, re-tighten nuts (A).

FIGURE 17 - BELT ADJUSTMENT

AIR BALANCE

⚠ CAUTION

On VAV units be certain that the VFD drive is set to maximum output, exhaust dampers are closed and individual space damper boxes are full open.

VFD units with bypass must not be in bypass mode ('LINE' position) unless all individual space dampers are full open.

Start the supply air blower motor. Adjust the resistances in both the supply and the return air duct systems to balance the air distribution throughout the conditioned space. The job specifications may require that this balancing be done by someone other than the equipment installer.

To check the supply air CFM after the initial balancing has been completed:

1. Remove the two 5/16" dot plugs from the blower motor and the filter access panels shown in the Dimensions and Clearances Figure 13.
2. Insert at least 8" of 1/4 inch tubing into each of these holes for sufficient penetration into the air flow on both sides of the indoor coil.

NOTE: The tubes must be inserted and held in a position perpendicular to the air flow so that velocity pressure will not affect the static pressure readings.

3. Using an inclined manometer, determine the pressure drop across a dry evaporator coil. Since the moisture on an evaporator coil may vary greatly, measuring the pressure drop across a wet coil under field conditions would be inaccurate. To assure a dry coil, the compressors should be deactivated while the test is being run.
4. Knowing the pressure drop across a dry coil, the actual CFM through the unit can be determined from the curve in Pressure Drop vs. Supply Air CFM Figure 18.

⚠ WARNING

Failure to properly adjust the total system air quantity can result in extensive blower damage.

After readings have been obtained, remove the tubes and reinstall the two 5/16" dot plugs that were removed in Step 1.

NOTE: DE-ENERGIZE THE COMPRESSORS BEFORE TAKING ANY TEST MEASUREMENTS TO ASSURE A DRY INDOOR COIL.

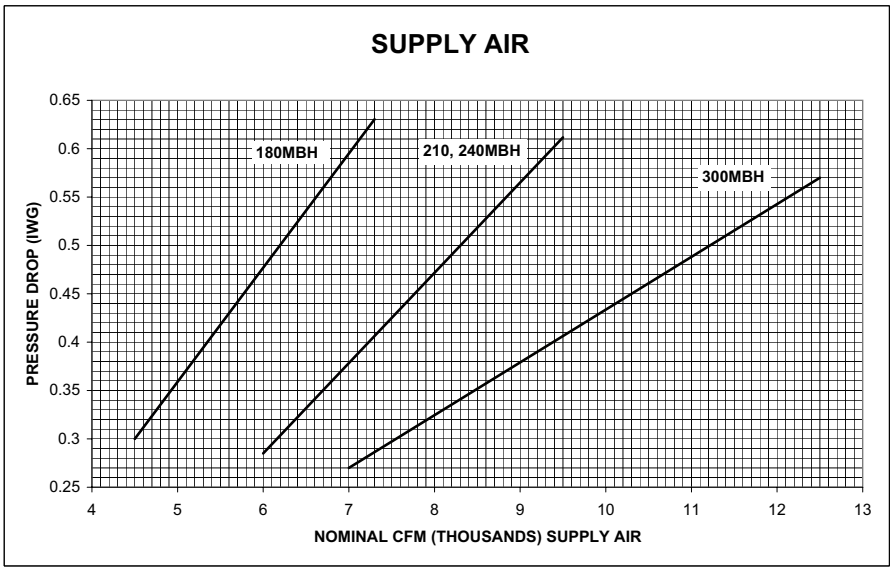


FIGURE 18 - PRESSURE DROP ACROSS A DRY INDOOR COIL VS SUPPLY AIR CFM FOR ALL UNIT TONNAGES

OPERATION

SEQUENCE OF OPERATIONS OVERVIEW

For these units, the thermostat makes a circuit between "R" and "Y1" for the first stage of cooling.

The call is passed to the unit control board (UCB), which then determines whether the requested operation is available and, if so, which components to energize.

For gas heating, the UCB monitors the "W1" call but does not handle the operation of the gas furnace. An ignition control board controls the gas heater operation.

For electric heat units, the UCB passes the call to the electric heater.

In both cases, when the "W1" call is sensed, the indoor air blower is energized following a specified heating delay.

If at any time a call for both heating and cooling are present, the heating operation will be performed. If operating, the cooling system is halted as with a completion of a call for cooling. Heating always takes priority.

COOLING SEQUENCE OF OPERATION

CONTINUOUS BLOWER

By setting the room thermostat fan switch to "ON," the supply air blower will operate continuously.

INTERMITTENT BLOWER

With the room thermostat fan switch set to "AUTO" and the system switch set to either the "AUTO" or "HEAT" settings, the blower is energized whenever a cooling or heating operation is requested. The blower is energized after any specified delay associated with the operation.

When energized, the indoor blower has a minimum run time of 30 seconds. Additionally, the indoor blower has a delay of 10 seconds between operations.

OPTIONAL VAV BLOWER OPERATION

For units with VFD, the speed of the indoor blower motor is controlled by duct static pressure. The duct static set point is the pressure that the drive will maintain when operating the unit in VAV mode. If the duct static pressure reaches or exceeds the high-limit setpoint, then the supply fan motor will be shutdown.

⚠ CAUTION

If the unit is operated with the manual bypass switch in the LINE (BYPASS) position and there are VAV boxes present in the duct system, then boxes must be driven to the full-open position using a customer-supplied power source to prevent over-pressurizing and possible damage to the ductwork.

NO OUTDOOR AIR OPTIONS

When the thermostat calls for the first stage of cooling, the low-voltage control circuit from "R" to "Y1" and "G" is completed. For first stage cooling, compressor #1, condenser fan motor #1 and condenser fan motor #2, 15T only (if the ambient temperature is above 60ºF), are energized. After completing the specified fan on delay for cooling, the UCB will energize the blower motor.

When the thermostat calls for the second stage of cooling, the low-voltage control circuit from "R" to "Y2" is completed. Compressor #2, and condenser fan motor #2, 20T only (if the ambient temperature is above 60ºF), are energized, provided it has not been locked-out.

If there is an initial call for both stages of cooling, the UCB will delay energizing compressor #2 by 30 seconds in order to avoid a power in rush.

Once the thermostat has been satisfied, it will de-energize Y1 and Y2. If the compressors have satisfied their minimum run times, the compressors and condenser fans are de-energized. Otherwise, the unit operates each cooling system until the minimum run times for the compressors have been completed. Upon the final compressor de-energizing, the blower is stopped following the elapse of the fan off delay for cooling.

To be available, a compressor must not be locked-out due to a high or low-pressure switch or freezestat trip and the anti-short cycle delay (ASCD) must have elapsed.

ECONOMIZER WITH SINGLE ENTHALPY SENSOR -

When the room thermostat calls for "first-stage" cooling, the low voltage control circuit from "R" to "G" and "Y1" is completed. The UCB energizes the blower

motor (if the fan switch on the room thermostat is set in the "AUTO" position) and drives the economizer dampers from fully closed to their minimum position. If the enthalpy of the outdoor air is below the setpoint of the enthalpy controller (previously determined), "Y1" energizes the economizer. The dampers will modulate to maintain a constant supply air temperature as monitored by the discharge air sensor. If the outdoor air enthalpy is above the setpoint, "Y1" energizes compressor #1, condenser fan motor #1, and condenser fan motor #2, 15T only (if the ambient temperature is above 60°F).

When the thermostat calls for "second-stage" cooling, the low voltage control circuit from "R" to "Y2" is completed. The UCB energizes the first available compressor if the enthalpy of the outdoor air is below the setpoint of the enthalpy controller (i.e. first stage has energized the economizer), "Y2" will energize compressor circuit #1. If the outdoor air is above the setpoint, "Y2" will energize compressor circuit #2.

Once the thermostat has been satisfied, it will de-energize Y1 and Y2. If the compressors have satisfied their minimum run times, the compressors and condenser fans are de-energized. Otherwise, the unit operates each cooling system until the minimum run times for the compressors have been completed. Upon the final compressor de-energizing, the blower is stopped following the elapse of the fan off delay for cooling, and the economizer damper goes to the closed position. If the unit is in continues fan operation the economizer damper goes to the min. position.

ECONOMIZER WITH DUAL ENTHALPY SENSORS -

The operation with the dual enthalpy sensors is identical to the single sensor except that a second enthalpy sensor is mounted in the return air. This return air sensor allows the economizer to choose between outdoor air and return air, whichever has the lowest enthalpy value, to provide maximum operating efficiency.

ECONOMIZER (SINGLE OR DUAL ENTHALPY) WITH POWER EXHAUST -

This system operates as specified above with one addition. The power exhaust motor is energized 45 seconds after the actuator position exceeds the exhaust fan setpoint on the economizer control. When the power exhaust is operating, the second stage of mechanical cooling will not operate. As always, the "R" to "G" connection provides minimum position but does not provide power exhaust operation.

ECONOMIZER WITH OPTIONAL VAV OR INTELLI-COMFORT™ CONTROL

The position of the outside air and return air dampers are controlled through a 2-10 VDC signal from the VAV or Intelli-Comfort™ control board. The economizer is enabled only in Occupied or Recovery mode. When the control is not powered or is in Unoccupied mode, the outside air dampers will be closed. When the supply fan is powered and there is no Y1 call, or if free-cooling is unavailable, the control opens the economizer dampers to the minimum position setting.

Free-cooling is available if the outdoor air temperature meets one of the three criteria discussed below, based upon the unit's configuration.

- **Dry Bulb**: The control refers to input from the Outside Air Temperature sensor and will allow free-cooling when the outdoor temperature is less than both the *First-Stage SAT Control* setpoint plus 5 °F, and the *Economizer OAT Enable* setpoint.
- **Single Enthalpy** (optional): A field-installed, Outdoor Air Humidity sensor is connected to the control. When the measured outdoor enthalpy is below the *Outside Air Enthalpy* setpoint, and the outdoor temperature is less than the *First-Stage SAT Control* setpoint plus 5 °F, free-cooling is available.
- **Dual Enthalpy** (optional): Both the field-installed Outdoor Air Humidity and the Return Air Humidity sensors are connected to the control. When the measured outdoor air enthalpy is less than the measured return air enthalpy, and the outdoor temperature is less than the *First-Stage SAT Control* setpoint plus 5 °F, free-cooling is available.

If free-cooling is available with a Y1 call, then the control modulates the economizer dampers to maintain the *First-Stage SAT Control* setpoint, plus or minus one degree. If free-cooling is unavailable, then 1st-stage mechanical cooling is initiated.

If at anytime the outdoor air temperature rises above the *First-Stage SAT Control* setpoint plus 5 °F, while free-cooling is available, then a Y1 call will also initiate 1st-stage mechanical cooling.

For a Y2 call, free-cooling is available based upon the criteria described above, except a *Second-Stage SAT Control* setpoint is used in the determination.

Once the call for cooling has been satisfied, it will de-energize any compressors and condenser fans, after the minimum compressor run times have been satisfied. Otherwise, the unit operates each cooling system until the minimum run times for the compressors have been completed.

Upon de-energizing the final compressor, the blower will continue to run with the economizer damper in its minimum position if in the Occupied mode; otherwise, the blower will stop following the elapse of the fan-off delay for cooling, and the economizer outdoor damper will close.

ECONOMIZER WITH OPTIONAL VAV BLOWER WITH POWER EXHAUST

The power exhaust motor is energized via the controller's EXH~ terminal and the ER relay, based on the position of the economizer damper parameter settings in the VAV control. Minimum run time is 10 seconds; minimum off time is 60 seconds. The outlet pressure of the power exhaust fan forces the barometric relief dampers open; gravity closes the dampers when the exhaust fan is off.

ECONOMIZER WITH OPTIONAL INTELLI-COMFORT™ WITH POWER EXHAUST

The power exhaust motor is energized via the exhaust relay based on the position of the economizer actuator's auxiliary switch adjustment screw. The adjustment screw represents the outdoor damper position at which to activate power exhaust, and can be set between 25 to 85 degrees open. The outlet pressure of the power exhaust fan forces the barometric relief dampers open; gravity closes the dampers when the exhaust fan is off.

MOTORIZED OUTDOOR AIR DAMPERS -

This system operation is the same as the units with no outdoor air options with one exception. When the "R" to "G" circuit is complete, the motorized damper drives open to a position set by the thumbwheel on the damper motor. When the "R" to "G" circuit is opened, the damper spring returns fully closed.

COOLING OPERATION ERRORS

Each cooling system is monitored for operation outside of the intended parameters. Errors are handled as described below. All system errors override minimum run times for compressors.

HIGH-PRESSURE LIMIT SWITCH

During cooling operation, if a high-pressure limit switch opens, the UCB will de-energize the associated compressor, initiate the ASCD (Anti-short cycle delay), and, if the other compressor is idle, stop the condenser fans. If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor.

Should a high-pressure switch open three times within two hours of operation, the UCB will lock-out the associated compressor and flash a code (see Table 32). If the other compressor is inactive, the condenser fans will be de-energized.

LOW-PRESSURE LIMIT SWITCH

The low-pressure limit switch is not monitored during the initial 30 seconds of a cooling system's operation. For the following 30 seconds, the UCB will monitor the low-pressure switch to ensure it closes. If the low-pressure switch fails to close after the 30-second monitoring phase, the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans.

Once the low-pressure switch has been proven (closed during the 30-second monitor period described above), the UCB will monitor the low-pressure limit switch for any openings. If the low-pressure switch opens for greater than 5 seconds, the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans.

If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor.

Should a low-pressure switch open three times within one hour of operation, the UCB will lock-out the associated compressor and flash a code (Table 32). If the other compressor is inactive, the condenser fans will be de-energized.

FREEZESTAT

During cooling operation, if a freezestat opens, the UCB will de-energize the associated compressor, initiate the ASCD, and, if the other compressor is idle, stop the condenser fans. If the call for cooling is still present at the conclusion of the ASCD, the UCB will re-energize the halted compressor.

Should a freezestat open three times within two hours of operation, the UCB will lock-out the associated compressor and flash a code (Table 32). If the other compressor is inactive, the condenser fans will be de-energized.

LOW AMBIENT COOLING

To determine when to operate in low ambient mode, the UCB has a pair of terminals connected to a temperature-activated switch set at 30ºF. When the low ambient switch is closed and the thermostat is calling for cooling, the UCB will operate in the low ambient mode.

Low ambient mode operates the compressors in this manner: 10 minutes on, 5 minutes off. The indoor blower is operated throughout the cycle. The 5-minute off period is necessary to defrost the indoor coil.

Low ambient mode always begins with compressor operation. Compressor minimum run time may extend the minutes of compressor operation. The defrost cycle will begin immediately following the elapse of the minimum run time.

When operating in low ambient mode, the UCB will not lockout the compressors due to a freezestat trip. However, a freezestat trip will de-energize the associated compressor. If the call for cooling is still present at the end of the ASCD and the freezestat has closed, the unit will resume operation.

SAFETY CONTROLS

The unit control board monitors the following inputs for each cooling system:

1. A suction line freezestat to protect against low evaporator temperatures due to a low airflow or a low return air temperature, (opens at 26 ± 5 °F and resets at 38 ± 5°F).
2. A high-pressure switch to protect against excessive discharge pressures due to a blocked condenser coil or a condenser motor failure, (opens at 380 ± 10 psig and resets at 300 ± 10 psig).
3. A low-pressure switch to protect against loss of refrigerant charge, (opens at 22 ± 5 psig and resets at 45 ± 5 psig).

The above pressure switches are hard-soldered to the unit. The refrigeration systems are independently monitored and controlled. On any fault, only the associated system will be affected by any safety/preventive action. The other refrigerant system will continue in operation unless it is affected by the fault as well.

The unit control board monitors the temperature limit switch of electric heat units and the temperature limit switch and the gas valve of gas furnace units.

COMPRESSOR PROTECTION

The compressors also have inherent (internal) protection. If there is an abnormal temperature rise in a compressor, the protector will open to shut down the compressor. The UCB incorporates features to minimize compressor wear and damage. An anti-short cycle delay (ASCD) is utilized to prevent operation of a compressor too soon after its previous run. Additionally, a minimum run time is imposed any time a compressor is energized.

The ASCD is initiated on unit start-up and on any compressor reset or lock-out.

FLASH CODES

The UCB will initiate a flash code associated with errors within the system. Refer to UNIT CONTROL BOARD FLASH CODES Table 32.

RESET

Remove the call for cooling, by raising thermostat setting higher than the conditioned space temperature. This resets any pressure or freezestat flash codes.

ELECTRIC HEATING SEQUENCE OF OPERATIONS

The following sequence describes the operation of the electric heat section.

⚠ CAUTION

For units with VFD and electric heat, the speed of the indoor blower motor continues to be controlled by duct static pressure via the VAV control board.

If there are VAV boxes present in the duct system, the boxes must be driven to the full-open position using a customer-supplied power source to assure adequate airflow across the heating elements.

Single-stage heating (applies only to 18 KW heater, all other heaters MUST use a two-stage thermostat):

a. Upon a call for heat by the thermostat, the heater contactor (6M) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor.

b. The thermostat will cycle the electric heat to satisfy the heating requirements of the conditioned space.

Two-stage heating (applies to all heaters except 18 KW):

a. Upon a call for first-stage heat by the thermostat, the heater contactor (6M) (6M & 7M on 72 KW, 240V) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor.

If the second stage of heat is required, heater contactor (7M) will be energized. Note that on the 54 KW, 240V heater, heater contactors (7M & 8M) will be energized and on the 72 KW, 240V heater, heater contactors (8M & 9M) will be energized. After completing the specified fan on delay for heating, the UCB will energize the blower motor.

b. The thermostat will cycle the electric heat to satisfy the heating requirements of the conditioned space.

NOTE: All 240 & 480V heaters are provided with manual reset backup protection limits. These will de-energize the heaters should the primary limit fail to open or the contactors fail to open in a failure mode.

HEATING OPERATION ERRORS

TEMPERATURE LIMIT

If the UCB senses zero volts from the high temperature limit, the indoor blower motor is immediately energized.

This limit is monitored regardless of unit operation status, i.e. the limit is monitored at all times.

If the temperature limit opens three times within one hour, it will lock-on the indoor blower motor and a flash code is initiated (See Table 32).

SAFETY CONTROLS

The unit control board monitors the temperature limit switch of electric heat units.

The control circuit includes the following safety controls:

1. Temperature Limit Switch (TLS 1, 2).

   This control is located inside the heater compartment and is set to open at the temperature indicated in the Limit Control Setting Table 27. It resets automatically. The limit switch operates when a high temperature condition, caused by inadequate supply air flow occurs, thus shutting down the heater and energizing the blower.

2. Temperature Limit Switch (TLS 3, 4, 5 and 6).

   This control is located inside the heater compartment and is set to open at the temperature indicated in the Limit Control Setting Table 27. It is a manual reset limit. These limit switches will de-energize the heaters should the primary limit fail to open or the contactors fail to open in a failure mode.

TABLE 27: LIMIT CONTROL SETTING

UNIT (Tons)	VOLTAGE	HEATER kW	TEMPERATURE LIMIT SWITCH 1, 2 OPENS, ºF	TEMPERATURE LIMIT SWITCH 3, 4, 5, 6 OPENS, ºF
15	240	18	120	170
		36	120	170
		54	120	170
		72	120	170
17.5 & 20	240	18	140	200
		36	140	200
		54	140	200
		72	140	200
15, 17.5, 20 & 25	460	18	120	170
		36	120	170
		54	120	170
		72	120	170
15, 17.5, 20 & 25	600	18	120	-
		36	120	-
		54	120	-
		72	120	-

FLASH CODES

The UCB will initiate a flash code associated with errors within the system. Refer to UNIT CONTROL BOARD FLASH CODES Table 32.

RESET

Remove the call for heating by lowering the thermostat setting lower than the conditioned space temperature. This resets any flash codes.

HEAT ANTICIPATOR SETPOINTS

It is important that the anticipator setpoint be correct. Too high of a setting will result in longer heat cycles and a greater temperature swing in the conditioned space. Reducing the value below the correct setpoint will give shorter "ON" cycles and may result in the lowering of the temperature within the conditioned space. Refer to Table 28 for the required heat anticipator setting.

TABLE 28: ELECTRIC HEAT ANTICIPATOR SETPOINTS

HEATER KW	VOLTAGE	SETTING, AMPS	
		TH1	TH2
18	208/230-3-60	0.29	-
36		0.29	0.29
54		0.29	0.58
72		0.29	0.58
18	460-3-60	0.29	-
36		0.29	0.29
54		0.29	0.29
72		0.29	0.29
18	575-3-60	0.29	-
36		0.29	0.29
54		0.29	0.29
72		0.29	0.29

GAS HEATING SEQUENCE OF OPERATIONS

The following sequence describes the operation of the gas heat section.

⚠ CAUTION

For units with VFD and gas heat, the speed of the indoor blower motor continues to be controlled by duct static pressure via the VAV control board.

If there are VAV boxes present in the duct system, the boxes must be driven to the full-open position using a customer-supplied power source to assure adequate airflow across the heat exchanger tubes.

When the thermostat calls for the first stage of heating, the low-voltage control circuit from "R" to "W1" and "G" is completed, thru the UCB. The heat relay "RW1" is energized. The "RW1-2" contacts close energizing the draft motor control. The draft motor control contacts close and start the draft motor. As the speed of the draft motor reaches approximately 2500 RPM, the centrifugal switch contact, located on the end of the draft motor shaft, closes to power the first stage ignition module "IC1", thru the "RW1-1 contacts.

Ignition module "IC1" will immediately start the first stage igniter sparking and will open the redundant valve located inside the first stage main gas valve "GV1" to allow a flow of gas to only the first stage carryover tube. Only after the pilot flame has been ignited and the presence of pilot flame detected at the "IC1" by a signal sent back through the flame sensor is sparking terminated and the first stage main gas valve opened.

Gas flows into each of the main burners and is ignited from the carryover tube flame.

After completing the specified fan on delay for heating, the UCB will energize the blower motor.

If "IC1" fails to detect a pilot flame, it will continue to try for a maximum of 85 seconds to ignite the pilot tube. If the pilot flame is not detected, then "IC1" will lock out first stage furnace operation for five minutes or until 24V power is removed from the module either at the unit or by resetting the room thermostat.

When the thermostat calls for the second stage of heating, the low-voltage control circuit from "R" to "W2" is completed, thru the UCB. Heat relay "RW2" is energized. The "RW2-1" contact is closed energizing the second stage ignition module "IC2". "IC2" will immediately start the second stage igniter sparking and will open the redundant valve located inside the second stage main gas valve "GV2" to allow a flow of gas to the second stage carryover tube. Only after the pilot flame has been ignited and the presence of pilot flame detected at "IC2" by a signal sent back through the flame sensor is sparking terminated and the main gas valve opened.

Gas flows into each of the second stage main burners and is ignited from the carryover tube flame.

If "IC2" fails to detect a pilot flame, it will continue to try for a maximum of 85 seconds to ignite the pilot tube. If the pilot flame is not detected, then "IC2" will lock out first stage furnace operation for five minutes or until 24V power is removed from the module either at the unit or by resetting the room thermostat.

NOTE: That the second stage furnace can operate even if first stage has locked out.

When the thermostat satisfies de-energizing the "RW2"and "RW1", thus opening all gas valves. The blower motor will continue to run after the furnace is shut down until the specified fan off delay for heating has been satisfied. The UCB will de-energize the blower motor.

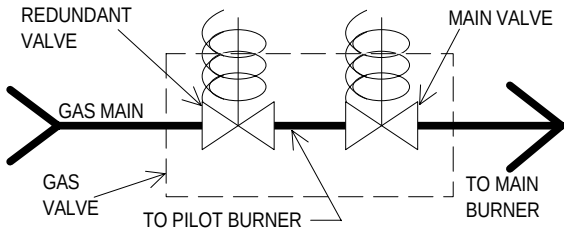


FIGURE 19 - GAS VALVE PIPING

When the thermostat calls for the first stage of heating, the low-voltage control circuit from "R" to "W1" is completed. A call for heat passes through the UCB to the ignition control board (ICB). The UCB monitors the "W1" call and acts upon any call for heat. Once voltage has been sensed at “W1”, the UCB will initiate the fan on delay for heating, energizing the indoor blower after the specified delay has elapsed.

When the thermostat has been satisfied, heating calls are ceased. The GV is immediately de-energized. The blower is de-energized after the fan off delay for heating has elapsed. The draft motor performs a 25-second post purge.

GAS HEATING OPERATION ERRORS

TEMPERATURE LIMIT

If the UCB senses zero volts from the high temperature limit, the indoor blower motor is immediately energized. When the UCB again senses 24 volts from the temperature limit, the draft motor will perform a 25-second post-purge and the indoor blower will be de-energized following the elapse of the fan off delay for heating.

This limit is monitored regardless of unit operation status, i.e. the limit is monitored at all times.

If the temperature limit opens three times within one hour, it will lock-on the indoor blower motor and a flash code is initiated (See Table 32).

GAS VALVE

The UCB continuously monitors the GV. Any time the UCB senses voltage at the GV without a call for heat for a continuous five-minute period, the UCB will lock-on the indoor blower and a flash code is initiated (Table 32). When voltage is no longer sensed at the GV, the UCB will de-energize the indoor blower following the elapse of the fan off delay for heating.

If voltage has been sensed at the GV for at least 15 seconds during the fan on delay for heating and GV voltage or "W1" is lost, the indoor blower is forced on for the length of the fan off delay for heating.

SAFETY CONTROLS

The unit control board monitors the temperature limit switch and the gas valve of gas furnace units.

The control circuit includes the following safety controls:

1. Limit Control (LS).

   This control is located inside the heat exchanger compartment and is set to open at the temperature indicated in the Limit Control Setting Table 29. It resets automatically. The limit switch operates when a high temperature condition, caused by inadequate supply air flow occurs, thus shutting

down the ignition control and closing the main gas valves and energizing the blower.

2. Centrifugal Switch (CS).

   If the draft motor should fail, the centrifugal switch attached to the shaft of the motor prevents the ignition controls and gas valves from being energized.

3. Redundant Gas Valve.

   There are two separate gas valves in the furnace. Each valve contains a main and a redundant valve. The redundant valves are located upstream of the main gas valves. Should either or both of the main gas valves fail in the open position the redundant valves serve as back-ups and shut off the flow of gas.

4. Flame Sensor Rod / 100% Ignition Control Lock-Out.

   The flame rods and controls are located per Proper Flame Adjustment Figure 22. If an ignition control fails to detect a signal from the flame sensor indicating the pilot flame is properly ignited, then the main gas valve will not open. It will continue to try and ignite the pilot for a maximum of 85 seconds, then if the pilot flame is not detected, the ignition control will lock out furnace operation until 24V power is removed from the module either at the unit or by resetting the room thermostat.

5. Rollout Switch.

   This switch is located above the main burners in the control compartment, which in the event of a sustained main burner rollout shuts off and locks out both ignition controls closing both gas valves. The ignition controls lock out furnace operation until 24V power is removed from the controls either at the unit or by resetting the room thermostat.

NOTE: The auto reset rollout switch must reset before allowing furnace operation.

6. Auxiliary limit switch (AUX) -

   This control is located inside the heat exchanger compartment and is set to open at 190°F. It is a manual reset switch. If AUX trips, then the primary limit has not functioned correctly. Replace the primary limit.

TABLE 29: LIMIT CONTROL SETTING

Units (Tons)	Capacity, MBH		Limit Control Opens, ºF
	Input	Output	
15, 17.5, 20 & 25	300	240	195
15, 17.5, 20 & 25	400	320	195

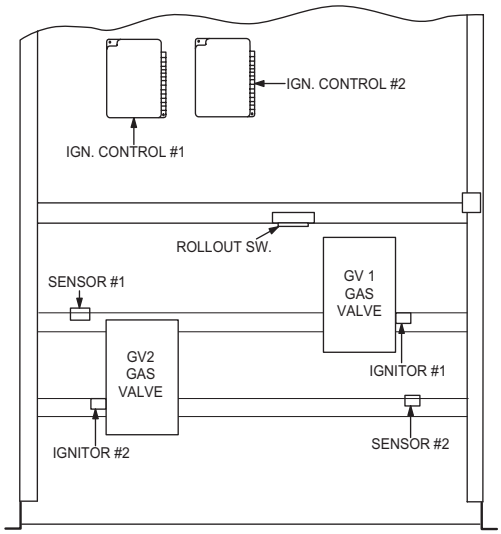


FIGURE 20 - GAS VALVE AND CONTROLS

FLASH CODES

The UCB will initiate a flash code associated with errors within the system. Refer to UNIT CONTROL BOARD FLASH CODES Table 32.

RESETS

Remove the call for heating by lowering the thermostat setting lower than the conditioned space temperature. This resets any flash codes.

HEAT ANTICIPATOR SETPOINTS

It is important that the anticipator setpoint be correct. Too high of a setting will result in longer heat cycles and a greater temperature swing in the conditioned space. Reducing the value below the correct setpoint will give shorter "ON" cycles and may result in the lowering of the temperature within the conditioned space.

TABLE 30: GAS HEAT ANTICIPATOR SETPOINTS

Gas Valve	Anticipator Setpoint	
	1st Stage	2nd Stage
Honeywell VR8440	0.30 amp	0.11 amp
White-Rodgers 36C68		

START-UP (COOLING)

PRESTART CHECK LIST

After installation has been completed:

1. Check the electrical supply voltage being supplied. Be sure that it is the same as listed on the unit nameplate.
2. Set the room thermostat to the off position.
3. Turn unit electrical power on.
4. Set the room thermostat fan switch to on.
5. Check indoor blower rotation.
   - If blower rotation is in the wrong direction. Refer to Phasing Section in general information section.
   - Check blower drive belt tension.
6. Check the unit supply air (CFM). See "CHECKING SUPPLY AIR CFM" on Page 43.
7. Measure evaporator fan motor's amp draw.
8. Set the room thermostat fan switch to off.
9. Turn unit electrical power off.

OPERATING INSTRUCTIONS

1. Turn unit electrical power on.
2. Set the room thermostat setting to lower than the room temperature.
3. First stage compressors will energize after the built-in time delay (five minutes).
4. The second stage of the thermostat will energize second stage compressor if needed.

POST START CHECK LIST

1. Verify proper system pressures for both circuits.
2. Measure the temperature drop across the evaporator coil.
3. Measure the system Amperage draw across all legs of 3 phase power wires.
4. Measure the condenser fan amp draw.

SHUT DOWN

1. Set the thermostat to highest temperature setting.
2. Turn off the electrical power to the unit.

START-UP (GAS HEAT)

PRE-START CHECK LIST

Complete the following checks before starting the unit.

1. Check the type of gas being supplied. Be sure that it is the same as listed on the unit nameplate.
2. Make sure that the vent and combustion air hoods have been properly installed.

OPERATING INSTRUCTIONS

⚠ CAUTION

This furnace is equipped with an intermittent pilot and automatic re-ignition system. DO NOT attempt to manually light the pilot.

TO LIGHT PILOT AND MAIN BURNERS:

1. Turn “off” electric power to unit.
2. Turn room thermostat to lowest setting.
3. Turn gas valve knob or switch to “on” position.
4. Turn “on” electric power to unit.
5. Set room thermostat to desired temperature. (If thermostat “set” temperature is above room temperature, pilot burner ignition will occur and, after an interval to prove pilot flame, main burners will ignite).

TO SHUT DOWN:

1. Turn “off” electric power to unit.
2. Depress knob of gas valve while turning to “off” position, or turn gas valve switch to “off” position.

POST-START CHECK LIST (GAS)

After the entire control circuit has been energized and the heating section is operating, make the following checks:

1. Check for gas leaks in the unit piping as well as the supply piping.

⚠WARNING

FIRE OR EXPLOSION HAZARD

FAILURE TO FOLLOW THE SAFETY WARNING EXACTLY COULD RESULT IN SERIOUS INJURY, DEATH OR PROPERTY DAMAGE.

NEVER TEST FOR GAS LEAKS WITH AN OPEN FLAME. USE A COMMERICALLY AVAILABLE SOAP SOLUTION MADE SPECIFICALLY FOR THE DETECTION OF LEAKS TO CHECK ALL CONNECTIONS. A FIRE OR EXPLOSION MAY RESULT CAUSING PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.

2. Check for correct manifold gas pressures. See “Checking Gas Input” Page 55.

3. Check the supply gas pressure. It must be within the limits shown on rating nameplate. Supply pressure should be checked with all gas appliances in the building at full fire. At no time should the standby gas line pressure exceed 13", nor the operating pressure drop below 5.0" for natural gas units. If gas pressure is outside these limits, contact the local gas utility for corrective action.

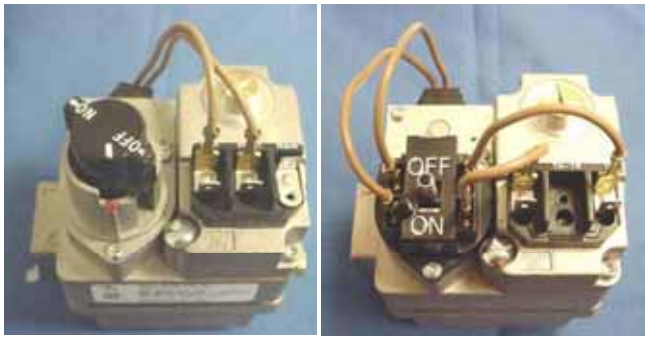


FIGURE 21 - TYPICAL GAS VALVES

MANIFOLD GAS PRESSURE ADJUSTMENT

Small adjustments to the high-fire gas flow may be made by turning the pressure regulator adjusting screw on the automatic gas valve.

Adjust as follows:

1. Remove the cap on the regulator. It's located next to the push-on electrical terminals.

2. To decrease the gas pressure, turn the adjusting screw counterclockwise.

3. To increase the gas pressure, turn the adjusting screw clockwise.

NOTE: The correct manifold pressure for these furnaces is 3.65 IWG ±0.3.

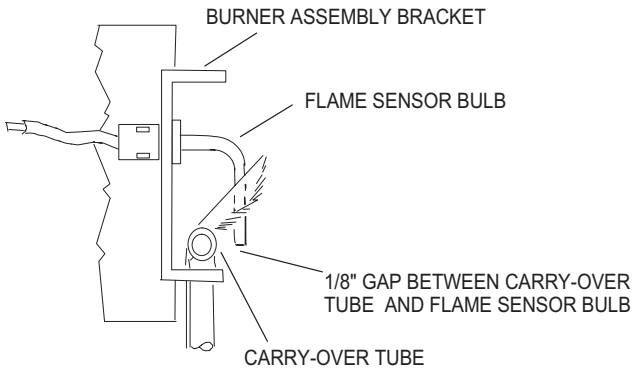


FIGURE 22 - PROPER FLAME ADJUSTMENT

PILOT CHECKOUT

The pilot flame should envelope the end of the flame sensor. To adjust pilot flame, (1) remove pilot adjustment cover screw, (2) increase or decrease the clearance for air to the desired level, (3) be sure to replace cover screw after adjustment to prevent possible gas leakage.

Put the system into operation and observe through complete cycle to be sure all controls function properly.

BURNER INSTRUCTIONS

To check or change burners, pilot or orifices, CLOSE MAIN MANUAL SHUT-OFF VALVE AND SHUT OFF ALL ELECTRIC POWER TO THE UNIT.

1. Remove the screws holding either end of the manifold to the burner supports.

2. Open the union fitting in the gas supply line just upstream of the unit gas valve and downstream from the main manual shut-off valve.

3. Remove the gas piping closure panel.

4. Disconnect wiring to the gas valves and spark igniters. Remove the manifold-burner gas valve assembly by lifting up and pulling back.

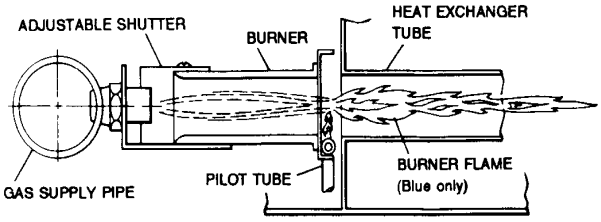


FIGURE 23 - TYPICAL FLAME APPEARANCE

Burners are now accessible for service.

Reverse the above procedure to replace the assemblies. Make sure that burners are level and seat at the rear of the heat exchanger.

BURNER AIR SHUTTER ADJUSTMENT

Adjust burner shutters so no yellow flame is observed in the heat exchanger tubes.

CHECKING GAS INPUT

NATURAL GAS

1. Turn off all other gas appliances connected to the gas meter.

2. With the furnace turned on, measure the time needed for one revolution of the hand on the smallest dial on the meter. A typical gas meter usually has a 1/2 or a 1 cubic foot test dial.

3. Using the number of seconds for each revolution and the size of the test dial increment, find the cubic feet of gas consumed per hour from the Gas Rate - Cubic Feet Per Hour Table 31.

If the actual input is not within 5% of the furnace rating (with allowance being made for the permissible range of the regulator setting), replace the orifice spuds with spuds of the proper size.

NOTE: To find the Btu input, multiply the number of cubic feet of gas consumed per hour by the Btu content of the gas in your particular locality (contact your gas company for this information - it varies widely from city to city.)

TABLE 31: GAS RATE - CUBIC FEET PER HOUR

Seconds for One Rev.	Size of Test Dial	
	1/2 cu. ft.	1 cu. ft.
4	450	900
6	300	600
8	228	450
10	180	360
12	150	300
14	129	257
16	113	225
18	100	200
20	90	180
22	82	164
24	75	150
26	69	138
28	64	129

Example: By actual measurement, it takes 13 seconds for the hand on the 1-cubic foot dial to make a revolution with just a 300,000 Btuh furnace running. Read across to the column in the table above, headed “1 Cubic Foot”, where you will see that 278 cubic feet of gas per hour are consumed by the furnace at that rate. Multiply 278 x 1050 (the Btu rating of the gas obtained from the local gas company). The result is 292,425 Btuh, which is close to the 300,000 Btuh rating of the furnace.

ADJUSTMENT OF TEMPERATURE RISE

The temperature rise (or temperature difference between the return air and the heated air from the furnace) must lie within the range shown on the rating plate and the data in the Gas Heat Application Table 4.

$$CFM = \frac{\text{Btuh Input x } 0.8}{108 \times {}^{\circ}F\ Temp.\ Rise}$$

After the temperature rise has been determined, the cfm can be calculated as follows:

After about 20 minutes of operation, determine the furnace temperature rise. Take readings of both the return air and the heated air in the ducts (about six feet from the furnace) where they will not be affected by radiant heat. Increase the blower cfm to decrease the temperature rise; decrease the blower cfm to increase the rise. Refer to the Blower Motor and Drive Data Table 26.

BELT DRIVE BLOWER

All units have belt drive single-speed blower motors. The variable pitch pulley on the blower motor can be adjusted to obtain the desired supply air CFM.

TROUBLESHOOTING

COOLING TROUBLESHOOTING GUIDE

⚠WARNING

Troubleshooting of components may require opening the electrical control box with the power connected to the unit. **Use extreme care when working with live circuits!** Check the unit nameplate for the correct line voltage and set the voltmeter to the correct range before making any connections with line terminals.

For troubleshooting of optional VFD, disconnect all power to the drive. Be aware that high voltages are present in the drive even after power has been disconnected. Capacitors within the drive must be allowed to discharge before beginning service.

When not necessary, shut off all electric power to the unit prior to any of the following maintenance procedures so as to prevent personal injury.

⚠ CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation, which could cause injury to person and/or damage unit components. Verify proper operation after servicing.

On calls for cooling, if the compressors are operating but the supply air blower motor does not energize after a short delay (the room thermostat fan switch is in the “AUTO” position).

1. Turn the thermostat fan switch to the ON position. If the supply air blower motor does not energize, go to Step 3.

2. If the blower motor runs with the fan switch in the ON position but will not run after the first compressor has energized when the fan switch is in the AUTO position, check the room thermostat for contact between R and G in the AUTO position during calls for cooling.

3. If the supply air blower motor does not energize when the fan switch is set to ON, check that line voltage is being supplied to the contacts of the M3 contactor, and that the contactor is pulled in. For units with VFD, check that line voltage is being supplied to the M3-Auxiliary contacts. Check for loose wiring between the contactor and the supply air blower motor.

4. If M3 is pulled in and voltage is supplied to M3, lightly touch the supply air blower motor housing. If it is hot, the motor may be off on internal protection. Cancel any thermostat calls and set the fan switch to AUTO. Wait for the internal overload to reset. Test again when cool.

5. If M3 is not pulled in, check for 24 volts at the M3 coil. If 24 volts are present at M3 but M3 is not pulled in, replace the contactor.

6. Failing the above, if there is line voltage supplied at M3, M3 is pulled in, and the supply air blower motor still does not operate, replace the motor.

   For units with VFD, if there is line voltage supplied at M3, M3 is pulled in, and the blower motor does not operate, check all power & control wiring connections to and from the drive and for any fault/warning messages displayed on the drive's digital display (refer to the drive user manual for full descriptions, if necessary). Clear any fault by pressing 'RESET' on the drive's keypad and take any corrective action as needed. If the motor still does not operate, replace the motor.

7. If 24 volts is not present at M3, check that 24 volts is present at the UCB supply air blower motor terminal, “FAN”. If 24 volts is present at the FAN, check for loose wiring between the UCB and M3.

8. If 24 volts is not present at the “FAN” terminal, check for 24 volts from the room thermostat. If 24

volts are not present from the room thermostat, check for the following:

a. Proper operation of the room thermostat (contact between R and G with the fan switch in the ON position and in the AUTO position during operation calls).

b. Proper wiring between the room thermostat and the UCB.

c. Loose wiring from the room thermostat to the UCB.

9. If 24 volts is present at the room thermostat but not at the UCB, check for proper wiring between the thermostat and the UCB, i.e. that the thermostat G terminal is connected to the G terminal of the UCB, and for loose wiring.

10. If the thermostat and UCB are properly wired, replace the UCB.

On calls for cooling, the supply air blower motor is operating but compressor #1 is not (the room thermostat fan switch is in the “AUTO” position).

1. If installed, check the position of the economizer blades. If the blades are open, the economizer is providing free cooling and the compressors will not immediately operate. If both stages of cooling are requested simultaneously and the economizer provides free cooling, following a short delay compressor #1 will be energized unless it is locked out. If compressor #1 is locked out, compressor #2 is energized. Compressor #2 is always energized in place of compressor #1 when compressor #1 is requested but locked out.

2. If no economizer is installed or the economizer is not opening to provide free cooling and compressor #1 does not energize on a call for cooling, check for line voltage at the compressor contactor, M1, and that the contactor is pulled in. Check for loose wiring between the contactor and the compressor.

3. If M1 is pulled in and voltage is supplied at M1, lightly touch the compressor housing. If it is hot, the compressor may be off on inherent protection. Cancel any calls for cooling and wait for the internal overload to reset. Test again when cool.

4. If M1 is not pulled in, check for 24 volts at the M1 coil. If 24 volts are present and M1 is not pulled in, replace the contactor.

5. Failing the above, if voltage is supplied at M1, M1 is pulled in, and the compressor still does not operate, replace the compressor.

6. If 24 volts is not present at M1, check for 24 volts at the UCB terminal, C1. If 24 volts is present, check for loose wiring between C1 and the compressor contactor.

7. If 24 volts is not present at the C1 terminal, check for 24 volts from the room thermostat at the UCB Y1 terminal. If 24 volts is not present from the room thermostat, check for the following:

a. 24 volts at the thermostat Y1 terminal.

b. Proper wiring between the room thermostat and the UCB, i.e. Y1 to Y1, Y2 to Y2.

c. Loose wiring from the room thermostat to the UCB.

8. If 24 volts is present at the UCB Y1 terminal, the compressor may be out due to an open high-pressure switch, low-pressure switch, or freezestat. Check for 24 volts at the HPS1, LPS1, and FS1 terminals of the UCB. If a switch has opened, there should be a voltage potential between the UCB terminals, e.g. if LPS1 has opened, there will be a 24-volt potential between the LPS1 terminals.

9. If 24 volts is present at the UCB Y1 terminal and none of the protection switches have opened, the UCB may have locked out the compressor for repeat trips. The UCB should be flashing an alarm code. If not, press and release the ALARMS button on the UCB. The UCB will flash the last five alarms on the LED. If the compressor is locked out, cancel any call for cooling. This will reset any compressor lock outs.

NOTE: While the above step will reset any lockouts, compressor #1 may be held off for the ASCD. See the next step.

10. If 24 volts is present at the UCB Y1 terminal and none of the switches are open and the compressor is not locked out, the UCB may have the compressor in an ASCD. Check the LED for an indication of an ASCD cycle. The ASCD should time out within 5 minutes. Press and release the TEST button to reset all ASCDs.

11. If 24 volts is present at the UCB Y1 terminal and the compressor is not out due to a protective switch trip, repeat trip lock out, or ASCD, the economizer terminals of the UCB may be improperly wired. Check for 24 volts at the Y1 “OUT” terminal of the UCB. If 24 volts is present, trace the wiring from Y1 “OUT” for incorrect wiring. If 24 volts is not present at the Y1 “OUT” terminal, the UCB must be replaced.

12. *For units without economizers*:If 24 volts is present at the Y1 OUT terminal, check for 24 volts at the Y1 “ECON” terminal. If 24 volts is not present, check for loose wiring from the Y1 “OUT” terminal

to the Mate-N-Lock plug, the jumper in the Mate-N-Lock plug, and in the wiring from the Mate-N-Lock plug to the Y1 “ECON” terminal.

13. *For units with economizers*: If 24 volts is present at the Y1 "OUT" terminal, check for 24 volts at the Y1 "ECON" terminal. If 24 volts is not present, check for loose wiring from the Y1 "OUT" terminal to the Mate-N-Lock plug, a poor connection between the UCB and economizer Mate-N-Lock plugs, loose wiring from the Mate-N-Lock plug to the economizer, back to the Mate-N-Lock plug, and from the Mate-N-Lock plug to the Y1 "ECON" terminal. If nothing is found, the economizer control may have faulted and is failing to return the 24-volt "call" to the Y1 "ECON" terminal even though the economizer is not providing free cooling. To test, disconnect the Mate-N-Locks and jumper between the WHITE and YELLOW wires of the UCB's Mate-NLock plug. If compressor #1 energizes, there is a fault in the economizer wiring or economizer control.

14. The UCB can be programmed to lock out compressor operation during free cooling and in low ambient conditions. These options are not enabled by default. Local distributors can test the UCB for this programming.

    For units with factory installed economizers, the UCB is programmed to lock out compressor operation when the LAS set point is reached.

    For units without factory installed or with field installed economizers, the UCB allows compressor operation all the time. This programming can be checked or changed by the local distributor.

15. If none of the above corrected the error, test the integrity of the UCB. Disconnect the C1 terminal wire and jumper it to the Y1 terminal. DO NOT jump the Y1 to C1 terminals. If the compressor engages, the UCB has faulted.

16. If none of the above correct the error, replace the UCB.

On calls for the second stage of cooling, the supply air blower motor and compressor #1 are operating but compressor #2 is not (the room thermostat fan switch is in the “AUTO” position).

1. If installed, check the position of the economizer blades. If the blades are open, the economizer is providing free cooling. If the second stage of cooling is requested, following a short delay, compressor #1 will be energized unless it is locked out. Typically, compressor #2 is energized only during free cooling if the call for the second stage of cooling persists for 20 minutes.

2. Compressor #2 will not energize simultaneously with compressor #1 if a call for both stages of cooling is received. The UCB delays compressor #2 by 30 seconds to prevent a power surge. If after the delay compressor #2 does not energize on a second stage call for cooling, check for line voltage at the compressor contactor, M2, and that the contactor is pulled in. Check for loose wiring between the contactor and the compressor.

3. If M2 is pulled in and voltage is supplied at M2, lightly touch the compressor housing. If it is hot, the compressor may be off on inherent protection. Cancel any calls for cooling and wait for the internal overload to reset. Test again when cool.

4. If M2 is not pulled in, check for 24 volts at the M2 coil. If 24 volts is present and M2 is not pulled in, replace the contactor.

5. Failing the above, if voltage is supplied at M2, M2 is pulled in, and the compressor still does not operate, replace the compressor.

6. If 24 volts is not present at M2, check for 24 volts at the UCB terminal, C2. If 24 volts are present, check for loose wiring between C2 and the compressor contactor.

7. If 24 volts is not present at the C2 terminal, check for 24 volts from the room thermostat at the UCB Y2 terminal. If 24 volts is not present from the room thermostat, check for the following:

    a. 24 volts at the thermostat Y2 terminal.

    b. Proper wiring between the room thermostat and the UCB, i.e. Y1 to Y1, Y2 to Y2.

    c. Loose wiring from the room thermostat to the UCB.

8. If 24 volts is present at the UCB Y2 terminal, the compressor may be out due to an open high-pressure switch, low-pressure switch, or freezestat. Check for 24 volts at the HPS2, LPS2, and FS2 terminals of the UCB. If a switch has opened, there should be a voltage potential between the UCB terminals, e.g. if LPS2 has opened, there will be 24 volts of potential between the LPS2 terminals.

9. If 24 volts is present at the UCB Y2 terminal and none of the protection switches have opened, the UCB may have locked out the compressor for

repeat trips. The UCB should be flashing a code. If not, press and release the ALARMS button on the UCB. The UCB will flash the last five alarms on the LED. If the compressor is locked out, remove any call for cooling at the thermostat or by disconnecting the thermostat wiring at the Y2 UCB terminal. This will reset any compressor lock outs.

NOTE: While the above step will reset any lock outs, compressor #1 will be held off for the ASCD, and compressor #2 may be held off for a portion of the ASCD. See the next step.

10. If 24 volts is present at the UCB Y2 terminal and none of the switches are open and the compressor is not locked out, the UCB may have the compressor in an ASCD. Check the LED for an indication of an ASCD cycle. The ASCD should time out within 5 minutes. Press and release the TEST button to reset all ASCDs.

11. The UCB can be programmed to lock out compressor operation during free cooling and in low ambient conditions. These options are not enabled by default. Local distributors can test the UCB for this programming.

    For units with factory installed economizers, the UCB is programmed to lock out compressor operation when the LAS set point is reached.

    For units without factory installed or with field installed economizers, the UCB allows compressor operation all the time. This programming can be checked or changed by the local distributor.

12. If none of the above corrected the error, test the integrity of the UGB. Disconnect the C2 terminal wire and jumper it to the Y2 terminal. DO NOT jump the Y2 to C2 terminals. If the compressor engages, the UCB has faulted.

13. If none of the above correct the error, replace the UCB.

On a call for cooling, the supply air blower motor and compressor #2 are operating but compressor #1 is not (the room thermostat fan switch is in the “AUTO” position).

1. Compressor #2 is energized in place of compressor #1 when compressor #1 is unavailable for cooling calls. Check the UCB for alarms indicating that compressor #1 is locked out. Press and release the ALARMS button if the LED is not flashing an alarm.

2. Check for line voltage at the compressor contactor, M1, and that the contactor is pulled in. Check for loose wiring between the contactor and the compressor.

3. If M1 is pulled in and voltage is supplied at M1, lightly touch the compressor housing. If it is hot, the compressor may be off on inherent protection. Cancel any calls for cooling and wait for the internal overload to reset. Test again when cool.

4. If M1 is not pulled in, check for 24 volts at the M1 coil. If 24 volts is present and M1 is not pulled in, replace the contactor.

5. Failing the above, if voltage is supplied at M1, M1 is pulled in, and the compressor still does not operate, replace the compressor.

6. If 24 volts is not present at M1, check for 24 volts at the UCB terminal, C1. If 24 volts is present, check for loose wiring between C1 and the compressor contactor.

7. If 24 volts is not present at the C1 terminal, check for 24 volts from the room thermostat at the UCB Y1 terminal. If 24 volts are not present at the UCB Y1 terminal, the UCB may have faulted. Check for 24 volts at the Y1 ECON terminal. If 24 volts is not present at Y1 “ECON”, the UCB has faulted. The UCB should de-energize all compressors on a loss of call for the first stage of cooling, i.e. a loss if 24 volts at the Y1 terminal.

8. If 24 volts are present at the UCB Y1 terminal, the compressor may be out due to an open high-pressure switch, low-pressure switch, or freezestat. Check for 24 volts at the HPS1, LPS1, and FS1 terminals of the UCB. If a switch has opened, there should be a voltage potential between the UCB terminals, e.g. if LPS1 has opened, there will be a 24-volt potential between the LPS1 terminals.

9. If 24 volts is present at the UCB Y1 terminal and none of the protection switches have opened, the UCB may have locked out the compressor for repeat trips. The UCB should be flashing a code. If not, press and release the ALARMS button on the UCB. The UCB will flash the last five alarms on the LED. If the compressor is locked out, remove any call for cooling. This will reset any compressor lock outs.

NOTE: While the above step will reset any lock outs, compressor #2 will be held off for the ASCD,

and compressor #1 may be held off for a portion of the ASCD. See the next step.

10. If 24 volts is present at the UCB Y1 terminal and none of the switches are open and the compressor is not locked out, the UCB may have the compressor in an ASCD. Check the LED for an indication of an ASCD cycle. The ASCD should time out within 5 minutes. Press and release the TEST button to reset all ASCDs.

11. If 24 volts is present at the UCB Y1 terminal and the compressor is not out due to a protective switch trip, repeat trip lock out, or ASCD, the economizer terminals of the UCB may be improperly wired. Check for 24 volts at the Y1 “OUT” terminal of the UCB. If 24 volts is present, trace the wiring from Y1 “OUT” for incorrect wiring. If 24 volts is not present at the Y1 “OUT” terminal, the UCB must be replaced.

12. *For units without economizers*: If 24 volts is present at the Y1 “OUT” terminal, check for 24 volts at the Y1 “ECON” terminal. If 24 volts is not present, check for loose wiring from the Y1 “OUT” terminal to the Mate-N-Lock plug, the jumper in the Mate-N-Lock plug, and in the wiring from the Mate-N-Lock plug to the Y1 “ECON” terminal.

    For units with economizers: If 24 volts is present at the Y1 "OUT" terminal, check for 24 volts at the Y1 "ECON" terminal. If 24 volts is not present, check for loose wiring from the Y1 "OUT" terminal to the Mate-N-Lock plug, a poor connection between the UCB and economizer Mate-N-Lock plugs, loose wiring from the Mate-N-Lock plug to the economizer, back to the Mate-N-Lock plug, and from the Mate-N-Lock plug to the Y1 "ECON" terminal. The economizer control may have faulted and is not returning the 24 volts to the Y1 "ECON" terminal even though the economizer is not providing free cooling. To test the economizer control, disconnect the Mate-N-Locks and jumper between the WHITE and YELLOW wires of the UCB's Mate-N-Lock plug.

13. The UCB can be programmed to lock out compressor operation during free cooling and in low ambient conditions. These options are not enabled by default. They can be checked by local distributors.

    For units with factory installed economizers, the UCB is programmed to lock out compressor operation when the LAS set point is reached.

    For units without factory installed or with field installed economizers, the UCB allows compressor operation all the time. This programming can be checked or changed by the local distributor.

14. If none of the above corrected the error, test the integrity of the UCB. Disconnect the C1 terminal wire and jumper it to the Y1 terminal. DO NOT jump the Y1 to C1 terminals. If the compressor engages, the UCB has faulted.

15. If none of the above correct the error, replace the UCB.

GAS HEAT TROUBLESHOOTING GUIDE

⚠WARNING

Troubleshooting of components may require opening the electrical control box with the power connected to the unit. **Use extreme care when working with live circuits!** Check the unit nameplate for the correct line voltage and set the voltmeter to the correct range before making any connections with line terminals.

For troubleshooting of optional VFD, disconnect all power to the drive. Be aware that high voltages are present in the drive even after power has been disconnected. Capacitors within the drive must be allowed to discharge before beginning service.

When not necessary, shut off all electric power to the unit prior to any of the following maintenance procedures so as to prevent personal injury.

⚠ CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation, which could cause injury to person and/or damage unit components. Verify proper operation after servicing.

NOTE: To find the Btu input, multiply the number of cubic feet of gas consumed per hour by the Btu content of the gas in your particular locality (contact your gas company for this information - it varies widely from city to city.).

⚠WARNING

The furnace may shut down on a high temperature condition during the procedure. If this occurs, the UCB energize the supply air blower motor until the high temperature limit has reset. Caution should be used at all times as the supply air blower may energize regardless of the room thermostat fan switch position.

On calls for heating, the draft motor operates and the furnace lights but the supply air blower motor does not energize after a short delay (the room thermostat fan switch is in “AUTO” position).

1. Place the thermostat fan switch in the “ON” position. If the supply air blower motor energizes, go to Step 9.

2. If the supply air blower motor does not energize when the fan switch is set to “ON,” check that line voltage is being supplied to the contacts of the M3 contactor, and that the contactor is pulled in. For units with VFD, check that line voltage is being supplied to the M3-Auxiliary contacts. Check for loose wiring between the contactor and the supply air blower motor.

3. If M3 is pulled in and voltage is supplied at M3, lightly touch the supply air blower motor housing. If it is hot, the motor may be off on inherent protection. Cancel any thermostat calls and set the fan switch to “AUTO”, wait for the internal overload to reset. Test again when cool.

4. If M3 is not pulled in, check for 24 volts at the M3 coil. If 24 volts is present at M3 but M3 is not pulled in, replace the contactor.

5. Failing the above, if there is line voltage supplied at M3, M3 is pulled in, and the supply air blower motor still does not operate, replace the motor.

   For units with VFD, if there is line voltage supplied at M3, M3 is pulled in, and the blower motor does not operate, check all power & control wiring connections to and from the drive and for any fault/ warning messages displayed on the drive's digital display (refer to the drive user manual for full descriptions, if necessary). Clear any fault by pressing 'RESET' on the drive's keypad and take any corrective action as needed. If the motor still does not operate, replace the motor.

6. If 24 volts is not present at M3, check that 24 volts is present at the supply air blower motor terminal on the UCB. If 24 volts is present at the UCB terminal, check for loose wiring between the UCB and M3. If 24 volts is not present at the UCB supply air blower motor terminal, check for 24 volts from the room thermostat. If 24 volts is not present from the room thermostat, check for the following:

   a. Proper operation of the room thermostat (contact between R and G with the fan switch in the “ON” position and in the “AUTO” position during operation calls).

   b. Proper wiring between the room thermostat and the UCB.

   c. Loose wiring from the room thermostat to the UCB.

7. If 24 volts is present at the room thermostat but not at the UCB, check for proper wiring between the thermostat and the UCB, i.e. that the thermostat G terminal is connected to the G terminal of the UCB, and for loose wiring.

8. If the thermostat and UCB are properly wired, replace the UCB.

9. If the blower motor runs with the fan switch in the “ON” position but does not run shortly after the furnace has ignited when the fan switch is in the “AUTO” position, check the room thermostat for contact between R and G during “W1” calls.

On calls for heating, the supply air blower operates but the draft motor does not (the room thermostat fan switch is in the “AUTO” position).

1. The draft motor has inherent protection. If the motor shell is hot to the touch, wait for the internal overload to reset.

2. If the motor shell is cold with the room thermostat calling for heat, check for line voltage at the motor's Mate-N-Lok connector attached to the evaporator partition. If line voltage is present, replace the draft motor.

3. If line voltage is not present, check for line voltage at the heat relay (RW1) contacts in the main control box and check to see if the (RW1) is pulled in.

4. If the (RW1) relay is pulled in, check for a loose line voltage connection.

5. If the (RW1) relay is not pulled in, check for 24 volts at the (RW1) coil. If 24 volts is present, replace the (RW1) relay. If 24 volts is not present, check for a loose 24 volt connection back to the relay board and check the connections from the room thermostat to the relay board. If all connections are correct, replace the relay board.

The draft motor runs but the furnace does not light and the sparker does not spark.

1. The ignition control (IC1, IC2) may be locked out due to either a flame roll out or 100% shut off. These safety features are described above. If lock-out has occurred, 24V must be removed from the ignition controls. This is done at the unit or by resetting the room thermostat. After resetting 24V, check for proper furnace operation. If lock-out continues to occur, locate the source of the problem and correct.

2. Check all 24 volt connections from the relay board to and in the gas heat section. Check low voltage connections to the (ETD) located in the control box.

3. If the furnace is hot, it may be out on an over-temperature condition, wait for limit reset.

4. If the furnace is cold, check for 24 volts at wire 241 attached to the electrical time delay (ETD) located in the main control box. If 24 volts is not found, replace the ETD.

5. 24 volts is found at wire 241, remove the wires attached to the (TDR) and with a VOM, check for continuity across contacts 1 and 2. If none is found, the (TDR) is open and must be replaced. If there is continuity, re-attach the wires.With the draft motor running, check for 24 volts at terminal 4 of (RW1-2) and (RW2-1). If 24 volts is not present, the centrifugal switch (CS) has not closed or has gone bad. Check the line voltage to the unit - if it is correct, replace the draft motor. If line voltage is low, call the power company.

6. Check for 24V at terminal 2 of (RW1-2 and RW2-1). If 24V is not present, check for 24V at (RW1 and RW2) relay coils. If these relays are pulled in, then check for a loose connection at terminal 2 and terminal 4 of each relay. If no problem is found, then replace (RW1 and/or RW2) as required.

7. If 24 volts is present at the ignitor controls, check all control wiring at the ignitor controls and the high tension wire to the ignitors. Check that the ground wires from the ignitor controls, the gas valves and pilot burners are all intact and making good electrical connection. Check to make sure that the ceramic insulator on the pilot ignitors or sensors is not broken or cracked, if all are intact, replace the ignition control IC1 or IC2.

The draft motor runs and the ignitor sparks at the pilot burner but the pilot does not ignite and a gas odor is not detected at the draft motor outlet.

1. Check to make sure gas is being supplied to the unit. Make sure that the gas pressure to the unit is within the proper limits as described in the “POST START CHECK LIST” Page 54 and that the pilot adjust screw is allowing some flow of gas as described in “PILOT CHECKOUT” Page 54.

2. Check all wiring between the ignitor control and the gas valve. Check to make sure the ground connections are intact.

3. If the wiring is intact, check for 24 volts across terminals “PV” and “COMMON” on the ignitor control. If 24 volts is not present, replace the ignitor control.

4. If 24 volts is present, remove the pilot burner and remove the pilot orifice from the pilot burner. The orifice is removed in the direction opposite the flow of gas. Inspect the orifice for obstruction. If it is clear, replace the main gas valve.

The ignitor sparks at the pilot burner but the pilot does not ignite and a gas odor is detected at the draft motor outlet.

1. Adjust the pilot adjust screw on the gas valve as described in “PILOT CHECKOUT” Page 54.

2. Check the supply pressure as described in “POST START CHECK LIST” Page 54. Make adjustments as necessary.

3. Check the pilot orifice for obstruction as described in paragraph above. Clean as needed but the problem should not be the gas valve.

The pilot burner ignites but the ignitor continues to spark and the main burners do not ignite.

1. Make the same checks and adjustment as described in “PILOT CHECKOUT” Page 54.
2. Check the supply pressure as described in “POST START CHECK LIST” Page 54. Make adjustments as necessary.
3. Make sure that the pilot burner is not bent or damaged.
4. Make sure that the ground connections at the pilot burner, gas valve and ignitor control are intact. Check the high tension wire for good electrical connection. If all are intact, replace the ignitor module.

The pilot burner lights and the spark stops but the main burners do not light.

1. Check electrical connections between the ignitor control and the gas valve. If intact, check for 24 volts across terminals “MV” and “COMMON” terminals. If no voltage detected, replace ignitor control. If voltage is present, replace gas valve.

Furnace lights with roll-out or one burner has delayed ignition.

1. Make sure that the pilot burner is aligned properly with the carryover as described in “PILOT CHECKOUT” Page 54.
2. Make sure that the carryovers on adjoining burners are screwed fast and are level with respect to one another.

Main burners light but exhibit erratic flame characteristics.

1. Adjust air shutters as described in “BURNER AIR SHUTTER ADJUSTMENT” Page 55.
2. Check the main burner orifices for obstruction and alignment. Removal procedure is described in BURNER INSTRUCTIONS Page 54. Clean or replace burner orifices and burners as needed.

UNIT CONTROL BOARD FLASH CODES

Various flash codes are utilized by the unit control board (UCB) to aid in troubleshooting. Flash codes are distinguished by the short on and off cycle used (approximately 200ms on and 200ms off). To show normal operation, the control board flashes a 1 second on, 1 second off "heartbeat" during normal operation. This is to verify that the UCB is functioning correctly. Do not confuse this with an error flash code. To prevent confusion, a 1-flash, flash code is not used.

Alarm condition codes are flashed on the UCB lower left Red LED, See Figure 24. While the alarm code is being flashed, it will also be shown by the other LEDs: lit continuously while the alarm is being flashed. The total of the continuously lit LEDs equates to the number of flashes, and is shown in the table. Pressing and releasing the LAST ERROR button on the UCB can check the alarm history. The UCB will cycle through the last five (5) alarms, most recent to oldest, separating each alarm flash code by approximately 2 seconds. In all cases, a flashing Green LED will be used to indicate non-alarm condition.

In some cases, it may be necessary to "zero" the ASCD for the compressors in order to perform troubleshooting. To reset all ASCDs for one cycle, press and release the UCB TEST/ RESET button once.

Flash codes that do and do not represent alarms are listed in Table 32.

TABLE 32: UNIT CONTROL BOARD FLASH CODES

FLASH CODE	DESCRIPTION	GREEN LED 16	RED LED 8	RED LED 4	RED LED 2	RED LED 1
On Steady	This is a Control Failure	-	-	-	-	-
1 Flash	Not Applicable	-	-	-	-	-
2 Flashes	Control waiting ASCD[1]	Flashing	Off	Off	On	Off
3 Flashes	HPS1 Compressor Lockout	Off	Off	Off	On	On
4 Flashes	HPS2 Compressor Lockout	Off	Off	On	Off	Off
5 Flashes	LPS1 Compressor Lockout	Off	Off	On	Off	On
6 Flashes	LPS2 Compressor Lockout	Off	Off	On	On	Off
7 Flashes	FS1 Compressor Lockout	Off	Off	On	On	On
8 Flashes	FS2 Compressor Lockout	Off	On	Off	Off	Off
9 Flashes	Ignition Control Locked Out / Ignition Control Failure	Off	On	Off	Off	On
10 Flashes	Compressors Locked Out on Low Outdoor Air Temperature[1]	Flashing	On	Off	On	Off
11 Flashes	Compressors locked out because the Economizer is using free Cooling[1]	Flashing	On	Off	On	On
12 Flashes	Unit Locked Out due to Fan Overload Switch Failure	Off	On	On	Off	Off
13 Flashes	Compressor Held Off due to Low Voltage[1]	Flashing	On	On	Off	On
14 Flashes	EEPROM Storage Failure	Off	On	On	On	Off
OFF	No Power or Control Failure	Off	Off	Off	Off	Off

1. Non-alarm condition.

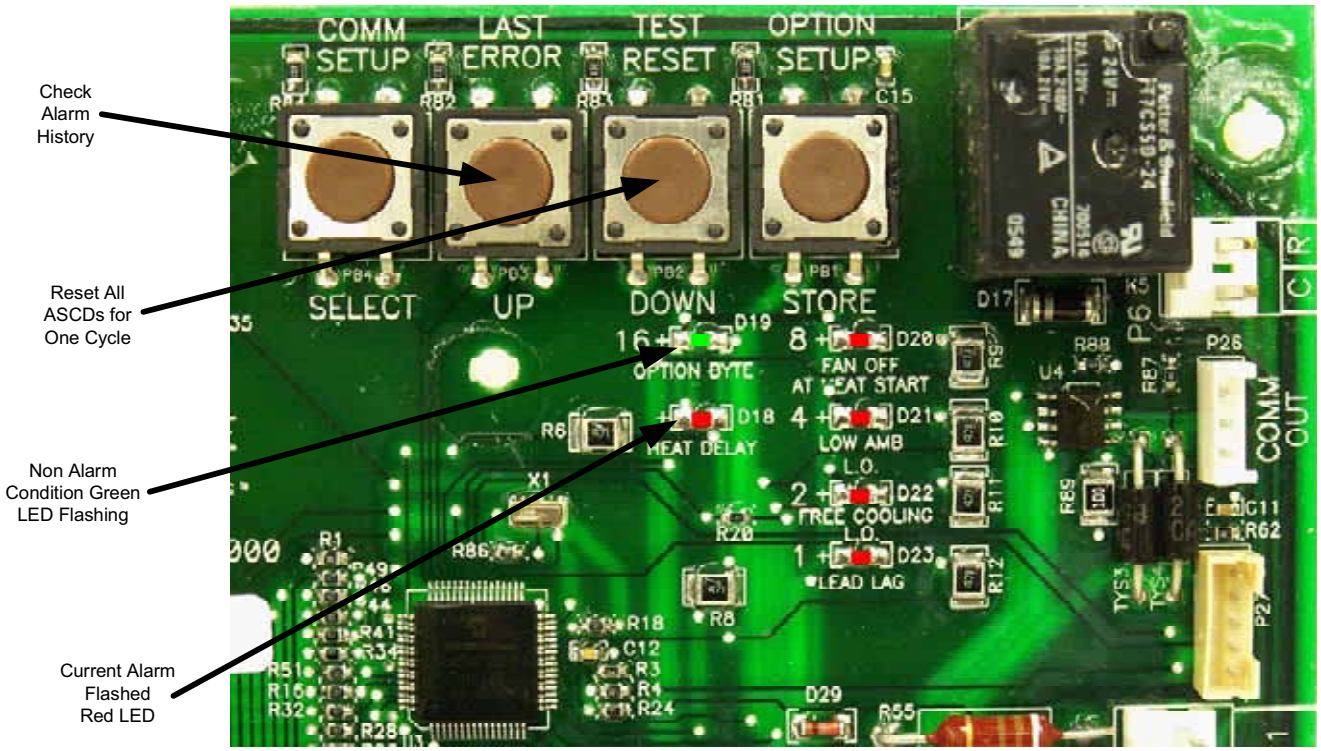


FIGURE 24 - UNIT CONTROL BOARD

UNIT CONTROL BOARD OPTION SETUP

OPTION BYTE SETUP

- Enter the Option Setup mode by pushing the OPTION SETUP / STORE button, and holding it for at least 2 seconds.
- The green status LED (Option Byte) will be turned on and the red status LED (Heat Delay) is turned off.
- The 8, 4, 2 and 1 LEDs will then show the status of the 4 labeled options (**(8) Fan Off at Heat Start**, **(4) Low Ambient Lockout**, **(2) Free Cooling Lockout**, and **(1) Lead / Lag)**.
- Press the UP or Down button to change the LED status to correspond to the desired Option Setup.
- To save the current displayed value, push the OPTION SETUP / STORE button and hold it for at least 2 seconds. When the value is saved, the green LED will flash a few times and then normal display will resume.

NOTE: While in either Setup mode, if no buttons are pushed for 60 seconds, the display will revert to its normal display, exiting the Option Setup mode. **When saving, the control board only saves the parameters for the currently displayed mode (Option Byte or Heat Delay).**

HEAT DELAY SETUP

- Enter the Option Setup mode by pushing the OPTION SETUP / STORE button, and holding it for at least 2 seconds.
- The green status LED (Option Byte) will be turned on and the red status LED (Heat Delay) is turned off.
- Press the COMM SETUP / SELECT button to toggle into the Heat Delay Setup, the green LED will turn off and the red LED for Heat Delay will turn on.
- The 8, 4, 2 and 1 LEDs will then show the status of the Heat Delay, (See Table 33). Press the UP or Down button to change the LED status to correspond to the desired Heat Delay Value.
- To save the current displayed value, push the OPTION SETUP / STORE button and hold it for at least 2 seconds. When the value is saved, the red LED will flash a few times and then normal display will resume.

NOTE: While in either Setup mode, if no buttons are pushed for 60 seconds, the display will revert to its normal display, exiting the Option Setup mode. **When saving, the control board only saves the parameters for the currently displayed mode (Option Byte or Heat Delay).**

TABLE 33: HEAT DELAY

Heat Fan On Delay	Heat Fan Off Delay	Red LED 8	Red LED 4	Red LED 2	Red LED 1
60	180	On	On	On	On
60	90	On	On	On	Off
60	60	On	On	Off	On
60	30	On	On	Off	Off
45	180	On	Off	On	On
45	90	On	Off	On	Off
45	60	On	Off	Off	On
45	30	On	Off	Off	Off
30	180	Off	On	On	On
30	90	Off	On	On	Off
30	60	Off	On	Off	On
30	30	Off	On	Off	Off
0	60	Off	Off	On	On
0	30	Off	Off	On	Off
0	10	Off	Off	Off	On
Non-std	Non-std	Off	Off	Off	Off

OPTIONAL VAV CONTROL BOARD FLASH CODES

Flash codes are also utilized by the VAV add-on board to aid in troubleshooting optional VAV applications. Flash codes are displayed by a red LED located near the center of the board using a short on/off cycle (approximately 200-ms on and 200-ms off).

To verify that the board is functioning correctly, the LED will display a repetitive 1 second on, 1 second off "heartbeat". Do not confuse this "heartbeat" with the error flash codes shown in the table below. To prevent confusion, a 1-flash, flash code is not used.

TABLE 34: VAV CONTROL BOARD FLASH CODES

FLASH CODE	DESCRIPTION
On Steady	Control Failure
1 Flash	Not Applicable
2 Flashes	Loss of Communication with UCB
3 Flashes	Space Sensor Failure
4 Flashes	SAT Sensor Failure
5 Flashes	RAT Sensor Failure
6 Flashes	OAT Sensor Failure
7 Flashes	OH Sensor Failure
8 Flashes	RH Sensor Failure
9 Flashes	IAQ Sensor Failure
10 Flashes	OAQ Sensor Failure
11 Flashes	APS Switch Failure
12 Flashes	Limit 2 Switch Open
13 Flashes	Purge
14 Flashes	VFD Input Failure
15 Flashes	Dirty Filter Switch
OFF	No Power or Control Failure

Subject to change without notice. Printed in U.S.A.
Copyright © 2007 by Unitary Products Group. All rights reserved.

284808-YIM-B-0707
Supersedes: 284808-YIM-A-0107

Unitary Products Group
5005 York Drive
Norman OK 73069